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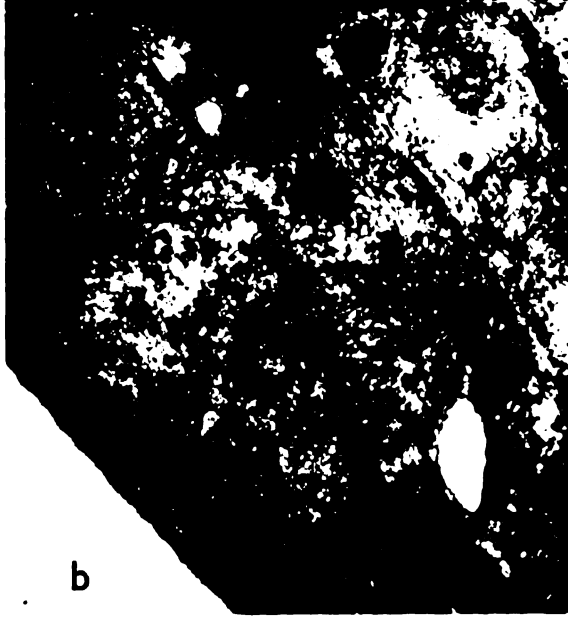
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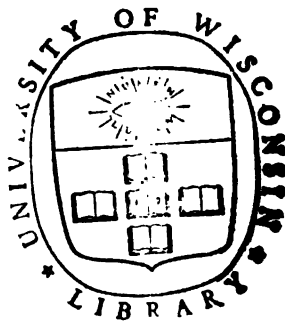
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Lunds botaniska förening



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## On the Fern Genera *Acrophorus*, *Diacalpe*, *Lithostegia* and *Peranema*

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### Introduction

The early genera of COPELAND's *Aspidiaceae* (COPELAND 1947) are mostly of rather ambiguous phylogeny and relationships. The small genera *Acrophorus*, *Diacalpe*, *Peranema* and *Lithostegia* are no exceptions though morphologically they are a little better known than most others of this group. The supposed similarities of these ferns with the primitive family *Cyatheaceae* and the hypothesis of a cyatheoid origin of the aspidioid phylum possibly have attracted the attention of pteridologists to these small tropical genera and significant contributions towards an understanding of their morphology has been made in the recent past (DAVIE 1912, 1916, THOMPSON 1943, VERMA 1958, NAYAR & KAUR 1963). The present study is an attempt to evaluate the morphology of the sporophyte and the gametophyte of these ferns in considerations of phylogeny and relationship.

All the four genera included in this study are terrestrial ferns restricted to the oriental tropics from N-E. India to the Philippine Islands; only in N-E. India all are reported to occur together. Except *Peranema*, which includes two species, they are monotypic.<sup>1</sup> The present study is based on *Acrophorus stipellatus* (Wall.) Moore (*A. nodosus* Presl, *Lithostegia nodosa* Presl), a large handsome fern with delicate pinnules and huge deltoid leaves, growing restricted to dense forest tracts; *Diacalpe aspidioides* Blume (*Sphaeropteris hookeriana* Wall.,

<sup>1</sup> Three species of *Diacalpe*, other than the type, are recognized by CHING (1949) and TAGAWA (1950) in the China-Japan region; ALSTON (1939) regards *Acrophorus lozoscaphoides* of New Guinea as distinct from *A. stipellatus*.

<sup>1</sup> *Botaniska Notiser* 1966.

*Peranema aspidioides* (Bl.) Mett.), also restricted to dense humid forests: *Lithostegia foeniculacea* (Hook.) Ching (*Aspidium foeniculaceum* Hook., *Peranema foeniculacea* (Hook.) Nayar et Kaur), a comparatively shaggy small fern of rather open areas near forest tracts; and *Peranema cyatheoides* Don (*Sphaeropteris barbata* Wall.), an elegant fern with large spreading deep-green finely dissected rather coarse leaves and large reddish-brown often boat-shaped paleae clothing the stipes and rachises. All except *Lithostegia* are moisture-loving plants, often restricted to semi-marshy areas in dense forests, and near small streams and cascades in sandy or even gravelly soil. They never grow in exposed localities, whereas *Lithostegia* is rarely found in deep forests. A detailed taxonomic account of these ferns is presented elsewhere (NAYAR & KAUR 1963).

### Material and Methods

Material for this study is collected solely from N-E. India, mainly from the K. & J. Hills of Assam. The usual techniques of study as are reported earlier (NAYAR & KAUR 1965 a, b) were followed. Spore morphology is studied mainly from acetolysed preparations and the methods used are the same as already described (NAYAR 1964). The development and morphology of the prothalli are studied from laboratory cultures raised on sterile nutrient agar medium in petridishes maintained at  $24 \pm 2^\circ\text{C}$  (NAYAR 1962). Throughout the study, the cultures received light of ca. 600 f-c. intensity for 12 hrs each day, the light source being sets of 40 watt daylight fluorescent lamps kept at a sufficient distance to avoid excessive heating of cultures. Observations on sporophyte morphology are based on material fixed in F.A.A. and preserved in 70 % Alcohol.

### Spores

The spores of all the genera are monolete, bilateral, planoconvex to slightly concavo-convex in lateral view, ovate or oblong in polar view, and measuring on an average  $20\text{--}25 \times 32\text{--}36 \mu$  (P  $\times$  E, exclusive of the perine), *A. stipellatus* possessing the smallest ( $20 \times 34 \mu$ ) and *P. cyatheoides* having the largest spores. They swell markedly on acetolysis, the average size of the acetolysed spores being  $26\text{--}32 \times 36\text{--}46 \mu$ , spores of *D. aspidioides* swelling proportionately more than those of the others (from  $22 \times 34$  to  $32 \times 46 \mu$ ). The laesura is tenuimarginate. The exine is  $1\text{--}2 \mu$  thick, light-brown in colour and with a smooth surface. There is a prominent brownish thin perine forming a loose jacket around the spore. The perine bears a granulose ornamentation

and is wrinkled into characteristic, thick, blunt, ridge-like, sharply demarkated folds which protrude about  $8\ \mu$  from the exine surface, and are convoluted and often assuming irregularly oval or circular shapes (Fig. 6 I). The folds in *A. stipellatus* (Fig. 6 H) are comparatively thinner, irregular and less conspicuously convoluted, many of the folds being parallel to the equatorial axis of the spore. The folds are rather crowded in *D. aspidioides* and *P. cyatheoides*. Fresh spores contain many pale yellowish-green plastids and small oil globules.

### Prothallial Development

On sowing, the spores germinate in a fortnight. The exine opens at the laesura and the germ filament emerges, usually preceded by the first rhizoid, but in some cases rhizoid formation is delayed. The germ filament becomes 4—6 cells long before the formation of a prothallial plate is initiated (Figs. 1 A, 2 G). The cells are barrel-shaped and densely chlorophyllous. Rhizoids are usually few (except in *Peranema*), nearly hyaline and non-chlorophyllous. The basal cell of the germ filament is short, but not bulbous. Under crowded conditions of growth and insufficient light, the basal cell and one or two cells next to it elongate markedly.

The development of a prothallial plate is initiated by longitudinal divisions in the terminal cell (Fig. 1 B), usually followed by similar divisions in the penultimate cell (Fig. 2 H, I). There is a good deal of variation in the pattern of development of the prothallial plate, even in the same species. An obconical apical meristematic cell is developed either early or rather late in development and this may in many cases be preceded by the formation of a terminal hair on the germ-filament. In all cases, however, the meristematic cell is developed in one of the daughter cells of the terminal cell. Soon after the longitudinal division of the terminal cell, the anterior region of the germ-filament expands, and an obconical meristematic cell may then be established by a wall formed oblique to the vertical wall separating the two daughter cells of the terminal cell (Fig. 1 C, D). In many cases, however, the development of a meristematic cell is delayed, the terminal and the penultimate cells of the germ-filament dividing several times and expanding to form an ameristic prothallial plate (Fig. 2 A—E). An obconical meristematic cell is later differentiated in one of the terminally placed marginal cells (Fig. 2 F). This condition is common in *Acrophorus* in which a meristematic cell is differentiated late in the



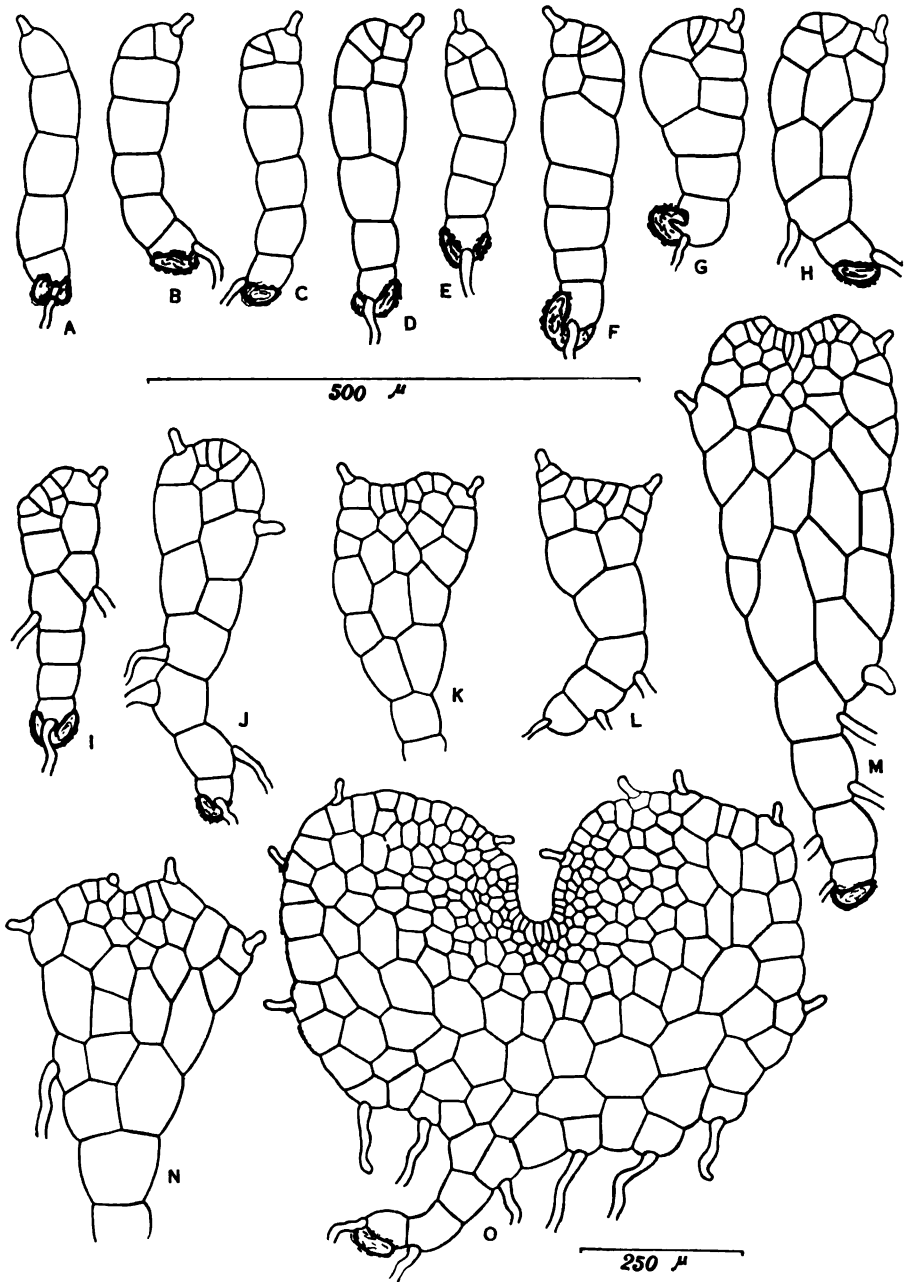


Fig. 1. Prothallial development in which meristematic cell is differentiated (D, J, K, M, N: *Peranema cyatheoides*; O: *Diacalpe aspidioides*; others: *Lithostegia foeniculacea*).

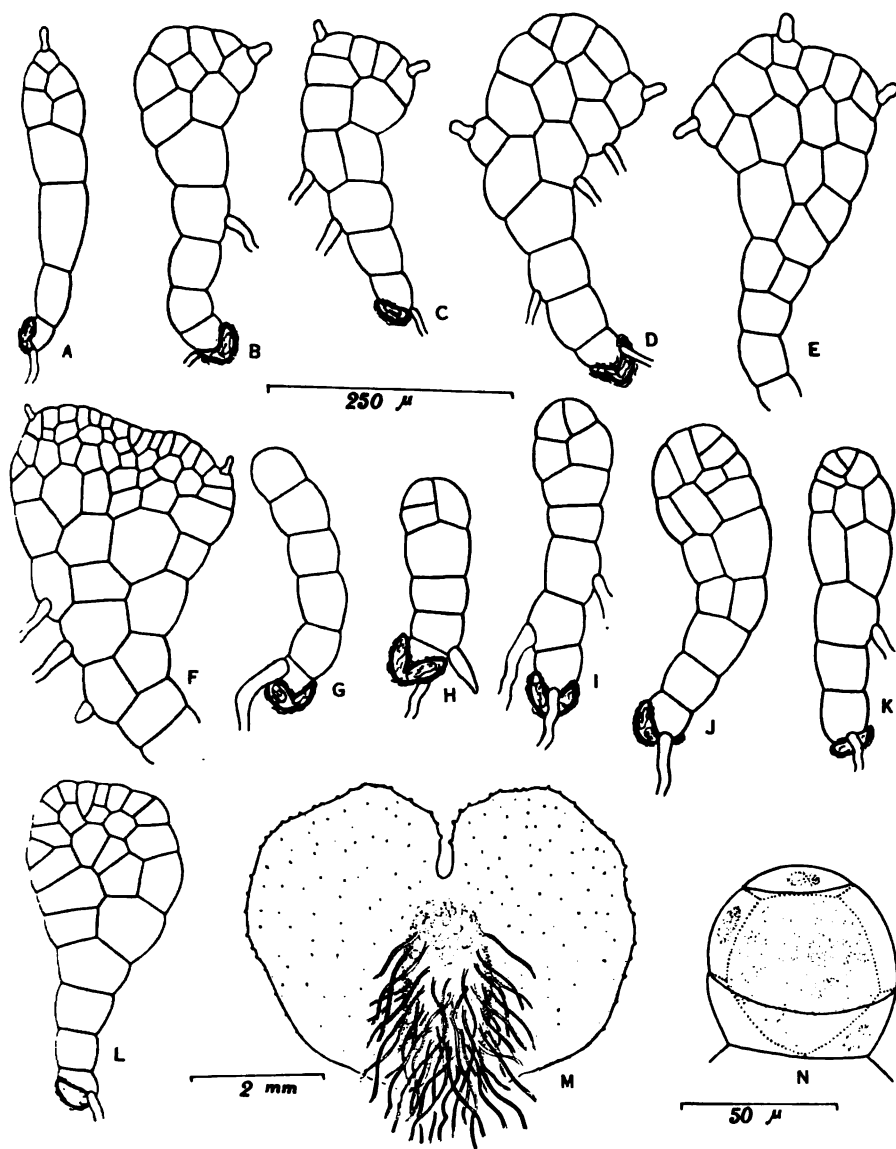


Fig. 2. A-F: Ameristic development of young prothalli (A: *Peranema cyatheoides*; F: *Acrophorus stipellatus*; others: *Lithostegia foeniculacea*). G-L: Young naked prothalli (K: *P. cyatheoides*; J, L: *A. stipellatus*; others: *L. foeniculacea*). M: Mature prothallus of *A. stipellatus*. N: Mature antheridium of *A. stipellatus*.

majority of prothalli. In *Peranema*, *Diacalpe* and *Lithostegia* the terminal cell of the germ filament often produces an apical, papillate hair before it divides longitudinally (Fig. 1 A). In such cases the terminal cell divides unequally (Fig. 1 B, E), the larger daughter cell bearing the hair. This hair-bearing cell sometimes divides transversely, and protrudes as a conical process, while the other daughter cell expands, pushing the hair-bearing cell to a lateral position. Usually an obconical meristematic cell is formed soon afterwards in the latter, by a wall formed oblique to the septum separating the two daughter cells of the terminal cell (Fig. 1 C, D). The first daughter cell cut off by the meristematic cell is on the side facing the hair-bearing cell (Fig. 1 G, H), but may rarely be on the opposite side in *Lithostegia* (Fig. 1 F). Often the sister cell of the meristematic cell develops a marginal papillate hair, soon after the meristematic cell is differentiated (Fig. 1 L). In some cases, the differentiation of a meristematic cell is delayed and the prothallial plate is ameristic for some time (Fig. 2 A-E). Rarely the division of the terminal cell of a germ-filament which has developed an apical hair, is so unequal that the sister cell of the hair-bearing daughter cell is narrowly wedge-shaped and resembles the obconical meristematic cell formed by young prothalli (Fig. 1 E). This cell, however, soon expands and divides in the usual way by a wall oblique to the septum separating it from the hair-bearing cell, thus establishing a meristematic cell. Rarely in young prothalli the meristematic cell is sluggish, and may later produce a marginal hair and stop growth. The thallus then continues growth ameristically and later develops a fresh obconical meristematic cell from one of the anterior marginal cells. Young prothalli are generally hairy, except in *Acrophorus*; in the latter, marginal hairs are produced only after a meristematic cell is differentiated (Fig. 2 J, L).

Young prothalli soon become spatulate and develop a notched apex, with the meristematic cell lodged at the bottom of the notch (Figs. 1 K, L, 2 L). The apical region broadens and the meristematic cell is replaced in the usual way (by a transverse division, followed by repeated longitudinal divisions in the outer daughter cell) by a multicellular meristem (Fig. 1 N). In *Diacalpe* the apical cell may persist till the prothallus is distinctly cordate with a deeply notched apex (Fig. 1 O); in the others it is replaced by a multicellular meristem soon after the apex of the thallus becomes notched. Rarely some of the ameristic young prothalli omit an apical cell stage, developing a multicellular meristem directly from the marginal cells. In *Peranema* and *Lithostegia* (more markedly

in the latter) there is a tendency for the young prothalli to elongate, many thalli becoming elongate-oblong in outline (Fig. 1 M).

In *Diacalpe* and *Acrophorus* the prothallus is generally broader than long (Figs. 1 O, 2 F), with an expanded anterior region tapering on to a uniseriate posterior region. Young cordate prothalli in all the genera bear papillate marginal hairs rather profusely. Similar superficial hairs are produced on the lower surface as the thallus becomes distinctly cordate.

### Mature Prothalli

Prothalli become full-grown in 6—8 months after spore germination. The mature prothallus (Fig. 2 M) is cordate, often broader than long, large and with a heavy (6—8 cells thick), broad midrib and flat, unruffled wings. The wing cells are uniformly thin-walled. The prothalli are profusely hairy, bearing both marginal and superficial (on both surfaces), unicellular, papillate or culb-shaped, chlorophyllous hairs devoid of any extracellular secretion: hairs, however, are more profuse on the margin and on the lower surface of the midrib than elsewhere. The superficial hairs are comparatively larger than the marginal ones. Multicellular hairs, as reported by SCHLUMBERGER (1911), are not observed in any of the species studied. Sex organs are of the usual type reported in advanced leptosporangiate ferns. The antheridia (Fig. 2 N) are sub-globose or oblong and are produced by prothalli from early spatulate stages onwards. The upper wall of the basal cell of the mature antheridium is prominently curved and touching the basal wall so that the basal cell is funnel-shaped. The opercular cell is single. In *Acrophorus* the antheridia are markedly larger than in the other genera studied. Archegonia begin to be produced when the prothalli are 5—6 months old. The archegonial neck is elongated, curved away from the apex of the prothallus and composed of 4 rows of 4—5 cells each. At maturity the basal tier of neck cells is divided longitudinally. The neck canal cell is slightly swollen at the apex and is bi-nucleate at maturity.

### Juvenile Sporophytes

The first juvenile leaf is with a cuneate lamina having a deeply dissected anterior margin (Fig. 5 E). The simplest leaf observed in cultures had a forked apex with the lobes forked again. The single vascular strand entering the lamina is forked at the base, each of the branches being forked again. Usually the vein is forked 3 or 4 times and the lamina is

dissected correspondingly, each ultimate veinlet entering a lobe. A midrib is developed in the 3rd or 4th leaf and originates near the first dichotomy of the vascular bundle entering the lamina. Soon the lamina becomes 3-lobed (Fig. 5 F, G), the midrib entering the median lobe. The midrib as well as the basal lateral veins are pinnately branched. The apex of the leaf becomes pronounced and the leaf becomes pronouncedly lobed. In succeeding juvenile leaves (Fig. 5 H), the lamina is progressively larger and gradually becomes pinnate and then decompound.

The juvenile leaves are profusely hairy. Unicellular papillate hairs resembling the prothallial hairs, but more elongated, are borne profusely over the margin and both surfaces (Fig. 5 Q). The marginal hairs are thin-walled and usually non-chlorophyllous. In *Peranema* the hairs are comparatively longer than in the other genera, and in many cases some of the hairs are much prolonged and flagellate especially on the earlier juvenile leaves (Fig. 5 R). In addition to the unicellular hairs the juvenile leaves bear larger club-shaped, densely chlorophyllous, thin-walled hairs composed of 2—4 short barrel-shaped cells (Fig. 5 P). These hairs are mostly restricted to the veins. Similar, but sparsely chlorophyllous, elongated hairs are found on the stipe and leaf base also. The hairs on the stipe and leaf base become progressively elongated in successive juvenile leaves, their anterior region being slender and much elongated. Multiseriate hairs resembling paleae are borne towards the leaf base by the 5th to 8th leaf onwards.

### The Adult Sporophytes

**Rhizome:** The rhizome of the adult sporophyte of all the genera is short, unbranched and erect (or suberect in early stages, as in *Dicalpe*). It is densely covered by roots and closely set, persistent, hard leaf-bases clothed by large (up to  $3.0 \times 0.5$  cms. in *Peranema*), dark-brown, basally attached paleae. Hairs occur mixed with the paleae; they are unicellular, short, club-shaped and with dense brown contents except in *Acrophorus* in which they are elongated, slender, and multicellular. The roots are thick, black, sparsely branched and covered by persistent, light brown root hairs. The cortex of the root is clearly demarcated into an outer parenchymatous region of radially arranged large cells (6—10 cells thick) and an inner sclerenchymatous region of smaller, dark-brown thick-walled cells (4—8 cells thick) with lamellated walls

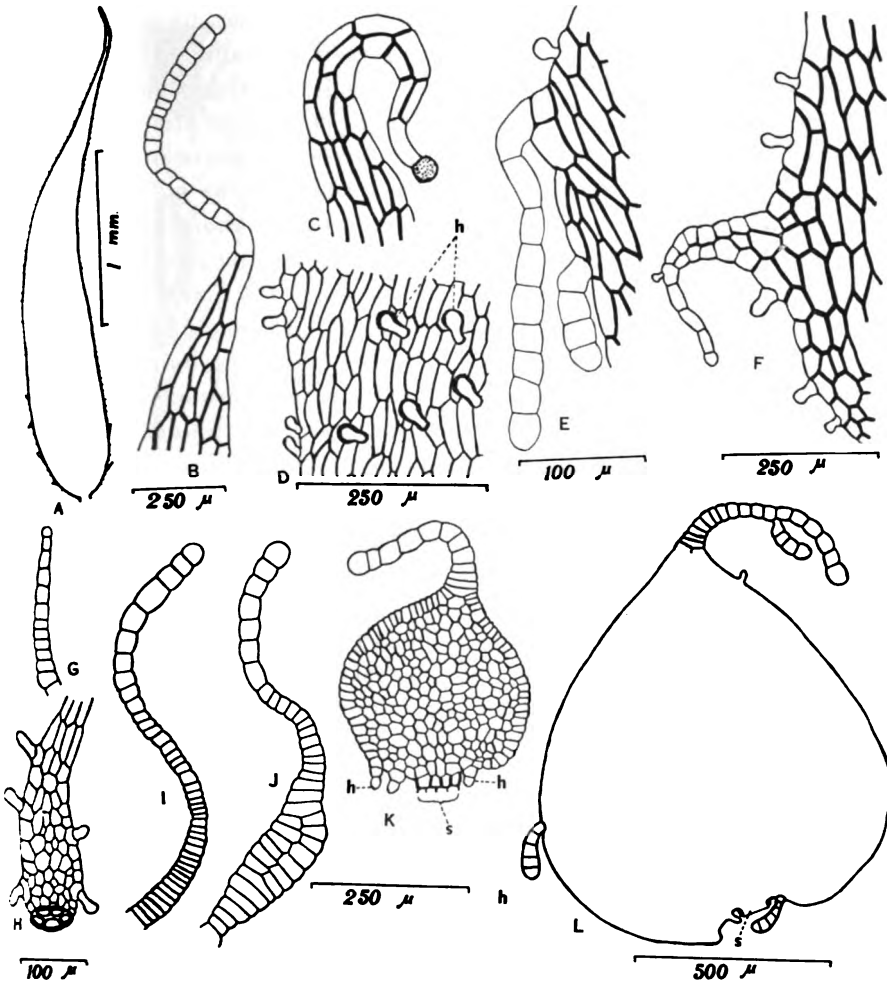


Fig. 3. Paleae (h: hair, s: stalk). — A: Mature palea of *L. foeniculacea*. B, C: Apex of the palea of *A. stipellatus* (B) and *P. cyatheoides* (C). D: A portion of the palea of *P. cyatheoides* showing marginal and superficial (h) hairs. E, F: Marginal hairs on the mature palea of *A. stipellatus* (E) and *L. foeniculacea* (F). G, H: Stages in the development of the palea of *D. aspidioides*. I-L: Same of *A. stipellatus*.

and pit connections between the cells. The xylem strand is diarch and ribbon-like.

The paleae (Fig. 3 A, L) are clathrate, basally attached, and ovate-lanceolate to ovate in shape. The stalk is broad, short (often over 10 cells broad and 2 or 3 cells long) and clearly demarcated from the body

of the palea. The apex of the palea (Fig. 3 C) tapers to an attenuated uniseriate tip which bears a rather swollen probably glandular cell; in *Acrophorus* the uniseriate region is much prolonged (Fig. 3 B) and the terminal cell is non-glandular though sometimes slightly swollen. The margin of the paleae is hairy; hairs are very sparse in *Acrophorus* and rather profuse, especially on the basal half of the paleae, in *Peranema* and *Lithostegia*. The hairs are unicellular, short and club-like: elongated, multicellular, uniseriate hairs, resembling the apical region of the paleae, are found in addition, usually restricted to the basal region of the palea in *Acrophorus* and *Lithostegia* (Figs. 3 E, F). Unicellular club-like hairs similar to the marginal hairs are found profusely on the outer surface of the palea in *Peranema* (Fig. 3 D). A few superficial multicellular hairs are sometimes found towards the base of the palea in *Acrophorus* but unicellular hairs are absent.

The paleae originate as cylindrical, uniseriate, elongated hairs (composed of small disc-shaped cells) close to the growing apex of the rhizome. In *Diacalpe*, *Lithostegia* and *Peranema*, when these hairs become 10—15 cells long, the basal region (except the basal cell) becomes more or less flattened and the hair curves towards the growing apex of the rhizome. The anterior cells elongate (Fig. 3 G), and soon the terminal cell becomes swollen and acquires dense protoplasmic contents. The cells of the basal half (except the basal cell) divide longitudinally, and by successive division and expansion of the daughter cells, develop into the broad, shield-like body of the palea. Meanwhile, the basal stalk cell divides and develops into a short flat stalk. Marginal and superficial hairs are developed only after the palea becomes broad and lanceolate (Fig. 3 H). In *Acrophorus* the palea originates as in *Peranema*, etc., but the uniseriate hair becomes very long, often composed of 50 or more disc-shaped cells. The cells of the anterior region are rather elongated, but those near the middle are very short (Fig. 3 I), due to active cell divisions in this region. The hair broadens in this region and longitudinal divisions set in (Fig. 3 J). Soon a broad ovate body is developed, tapering sharply on to the elongated (15—20 cells long) uniseriate anterior region (Fig. 3 K, L). Marginal multicellular hairs may be developed from this stage onwards. The marginal cells of the young palea are often regularly arranged, narrow and radially elongated.

The rhizome is parenchymatous and the cells of the ground tissue possess dense deposits of starch. Slender, cylindrical, dark-brown to blackish strands of sclerenchymatous cells are scattered throughout in

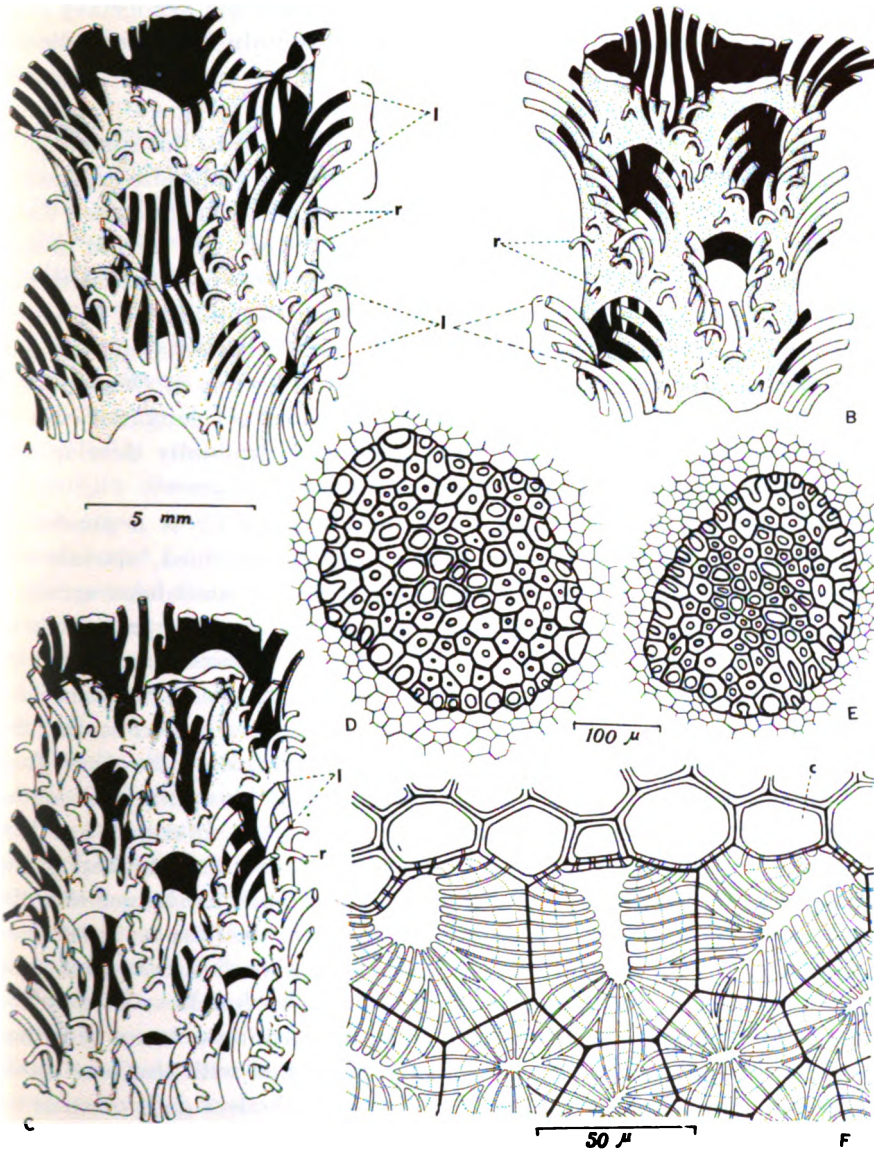


Fig. 4. Morphology of the rhizome (r: root trace, l: leaf trace, c: cortical parenchyma). — A-C: Stelar cylinders of a portion of the rhizome of *A. stipellatus* (A), *P. cyatheoides* (B) and *D. aspidioides* (C). D, E: T.s. of sclerenchymatous strand in the ground tissue of the rhizome of *A. stipellatus* (D) and *L. foeniculacea* (E). F: A portion of E showing nature of cells.



the ground tissue. These strands vary much in size but are usually 30—50 cells thick (some of the smaller strands are only 2 or 3 cells thick) and composed of narrow elongated cells. The strands have a nearly smooth contour (Fig. 4 E), except in *Acrophorus* (Fig. 4 D), and the peripheral wall of the outer layer of cells (adjacent to the surrounding parenchyma) is unthickened (Fig. 4 F), as described in some Polypodiaceous (NAYAR 1963 a, 1963 b), and Lomariopsidoid ferns (NAYAR & KAUR 1964 a). The cells of the sclerenchymatous strands are devoid of any contents and possess highly thickened, dark-brown, lamellated and pitted walls (Fig. 4 F). Except for the cells in the middle of the larger strands, which possess a wide lumen, the lumen is occluded. Towards the apex of the rhizome the sclerenchymatous strands in *Diacalpe* and *Lithostegia* are differentiated as uniseriate rows of elongated cells in the promeristem region. These cells divide and gradually develop into the multiseriate thick-walled strand as the rhizome grows.

The vascular cylinder of the rhizome (Fig. 4 A-C) is a condensed dictyostele dissected by closely placed, spirally arranged, obovate leaf gaps and appearing in a t.s. as 5—9 strap-shaped meristeles arranged in a circle. The surface of the stelar cylinder is irregular, especially in *Diacalpe*, the stelar cylinder of which (Fig. 4 C) bears many irregular longitudinal ridges on both surfaces. The leaf gaps are comparatively very large in *Acrophorus* (Fig. 4 A) and are closely placed so that the meristeles are usually narrow and well separated from each other. They are in 3 or 4 closely placed spirals around the stelar cylinder in all the genera. Vascular connection to each leaf (Fig. 4 A-C, 1) consists of 5—8 (up to 12 in *Acrophorus*) slender cylindrical strands attached to the margins of the leaf gap. The adaxial pair of strands are larger than the others: in *Peranema* the abaxial strand of the leaf trace is often as prominent as the adaxial strands. The leaf trace bundles often have irregular vascular commissures between nearby bundles; in *Diacalpe* commissures are more common, sometimes forming a loose reticulum at the leaf base. Root traces are mostly associated with the leaf traces, the large majority of them originating close to the leaf gap, often at the base of the leaf trace bundles, so that there are clusters of roots around each leaf base. Some root traces originate along with the leaf trace bundles from the margin of the leaf gap, while a few originate as slender superficial or lateral branches of some of the leaf trace bundles themselves. Except in *Acrophorus* the first vascular strand originating at the posterior end of each leaf gap is often a root trace. Branching of the rhizome is uncommon. Where branches occur, they are unassociated

with the leaves. The vascular cylinder forks unequally to supply the branch of the rhizome, the branch trace being a cylindrical, solenostelic strand.

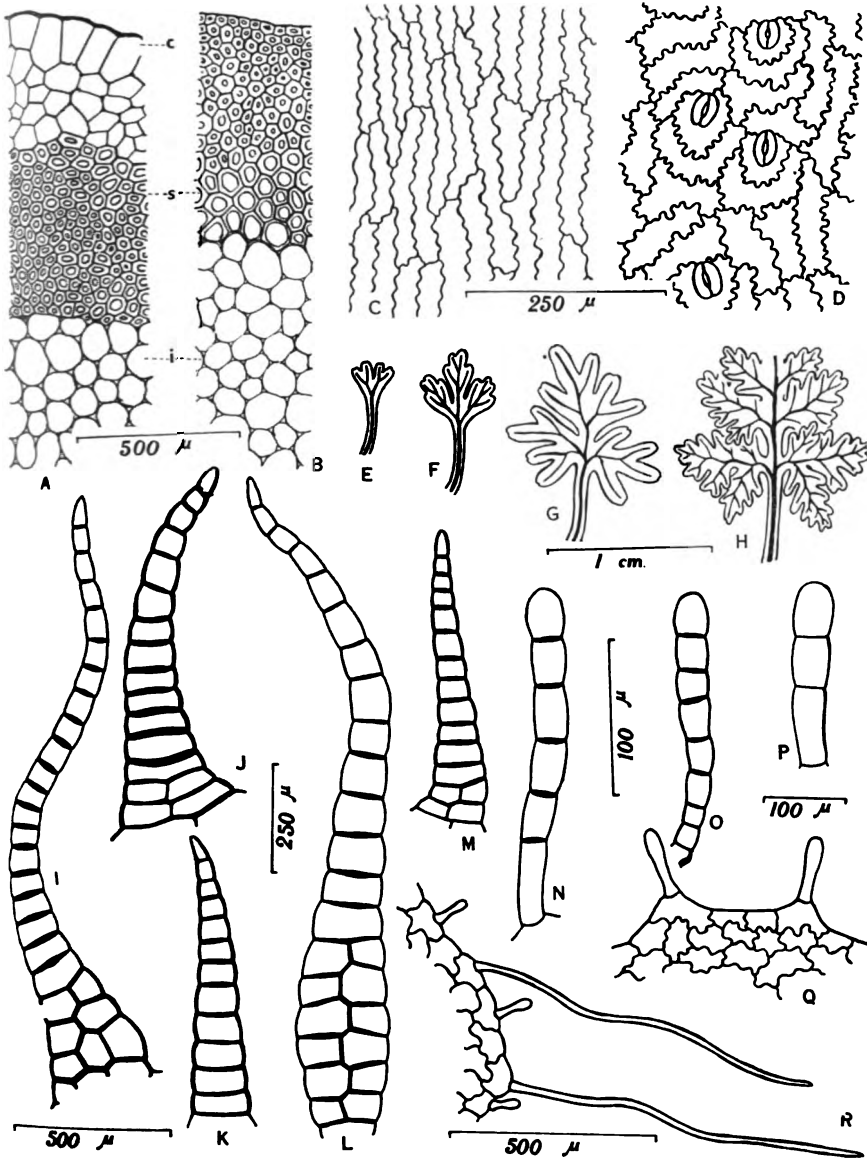
**Leaf:** The leaves in all genera are large, decompose (see NAYAR & KAUR 1964, for detailed morphological descriptions), crowded and arranged spirally over the rhizome. The stipe is long, hard and cylindrical with a shallow median longitudinal groove on the adaxial side. Paleae similar to those on the rhizome, but often larger, cover the young stipe; in *Acrophorus* they are deciduous so that the stipe is ultimately naked and glossy. Superficial hairs as found on the paleae of the rhizome are generally absent. In all genera, except *Acrophorus*, small club-shaped unicellular hairs occur mixed with the paleae on the stipe; larger multicellular uniseriate hairs are found in addition in *Diacalpe* and *Lithostegia*. Prominent, slender aerenchyma bands, one on either side of the stipe, are found in all genera, but are more conspicuous in *Diacalpe* and *Lithostegia*.

The ground tissue of the stipe, except a few (10—14) layers of cells towards the periphery are parenchymatous. In *Acrophorus* and *Peranema* the epidermis and 4 or 5 layers of the hypodermal cells are thin-walled (Fig. 5 A), but in *Diacalpe* and *Lithostegia* (Fig. 5 B) the epidermis and a few layers of cells below it are thick-walled, forming a hard, peripheral sclerenchymatous sheath. The thickening of the wall is progressively less and the cells are gradually larger in size towards the centre of the stipe so that the thick-walled peripheral region merges imperceptibly with the parenchymatous central region of the stipe. In *Acrophorus* and *Peranema*, on the other hand, there is a cortical sclerenchymatous sheath sharply demarcated from the parenchymatous tissue on either side (Fig. 5 A). This sheath is often 10—15 cells thick, and consists of dark-brown, highly thick-walled cells which are markedly narrower than the parenchyma cells on either side, and elongated along the length of the stipe. Broad lateral bands of parenchymatous aerating tissue interrupt the sclerenchymatous sheath in all the genera. Towards the base of the stipe slender cylindrical sclerenchymatous strands similar to and continuous with those of the rhizome are present scattered in the parenchymatous ground tissue of the stipe. Further up the stipe these sclerenchymatous strands merge imperceptibly with the parenchymatous ground tissue. The rachis is similar to the stipe in structure; the dorsal groove is often more prominent. In *Acrophorus* the regions at which branches are borne by the rachis are

prominently swollen and covered by a dense felt of persistent dark-brown hairs. These hairs are non-glandular, thick, often tortuous and with a broad multiseriate base (Fig. 5 I). Vascular strands are many (8—10) per stipe and arranged in the form of a gutter; the adaxial strands (and one abaxial strand in *Peranema*) are larger than the others. During their course up the rachis the lateral vascular strands progressively fuse with the adaxial strand on either side so that towards the apex there remain only 3 strands, 2 adaxial and 1 abaxial. Near the apex the two adaxials merge into one and later fuse with the abaxial one. The vascular connection to the secondary branches of the rachis originates as a solitary branch from the adaxial bundle on that side. In larger branches this vascular strand soon splits into two or three.

The leaf lamina is deltoid, decomposed and finely dissected with small pinnately lobed ultimate segments. Venation is pinnate, each main lateral vein of the midrib supplying one lobe of the lamina. The main veins are pinnate in the larger lobes but may be only once forked in the smaller lobes, particularly of *Lithostegia*. The ultimate veinlets are free, possess slightly swollen apices and terminate below the margin of the lamina. The epidermis of the leaf (Fig. 5 C, D) is thin-walled, chlorophyllous and with highly sinuous contour (in surface view); the lateral walls of the upper epidermis are less sinuous compared to that of the lower epidermis. In both cases the epidermal cells are elongated parallel to the lateral veins of the pinna lobes. Stomata are restricted to the lower epidermis. They are ovoid in outline with the guard cells elongated nearly parallel to the veins of the lamina. The epidermal cell subtending the stoma (the sister cell of the stoma initial) is different from the other epidermal cells in being transversely elongated and nearly surrounding the guard cells except at the anterior end (Fig. 5 D). Often the epidermal cell next to it is also transversely elongated and surrounding the subtending cell half-way around. Often there is only a single epidermal cell anterior to the stoma (so that the stoma is surrounded by two cells: one subtending it and one anterior to it), and in such cases this cell is also transversely elongated. The mesophyll tissue of the leaf is undifferentiated and composed of large armed parenchyma cells. Hairs occur profusely over the lamina in all the genera, but are mostly shed as the leaves mature. On mature leaves the lamina is often nearly glabrous on both surfaces except for a few hairs over the veins.

Fig. 5. Morphology of the leaf (c: cortical parenchyma, s: sclerenchymatous sheath, i: inner ground tissue). — A, B: Portions of the cortical region of the stipe of *P. cyatheoides* (A) and *L. foeniculacea* (B). C, D: Upper and lower foliar epidermis of



*P. cyatheoides*. E-H: Juvenile leaves showing succession in form and venation in *A. stipellatus* (E, F, H) and *P. cyatheoides* (G). I: Hairs on the rachis of *A. stipellatus*. J-M: Acicular hairs over the veins of *A. stipellatus* (J, K), *D. aspidioides* (L), *L. foeniculacea* (M). N, O: Club-shaped foliar hairs of *P. cyatheoides* (N) and *A. stipellatus* (O). P: Hair on the juvenile lamina of *A. stipellatus*. Q, R: Portions of the margin of the juvenile leaf of *P. cyatheoides* showing unicellular hairs.

These hairs are characteristic in being large, stiff, dark brown, acicular, jointed, and uniseriate (except at the base where it is often 2 cells thick), composed of short disc-shaped thick-walled cells (Fig. 5 J-M). In *A. stipellatus* they are often brittle. In *D. aspidioides* some of the larger hairs resemble small paleae (Fig. 5 L). Similar hairs are found on the branches of the rachis, often mixed with reduced paleae; they are more numerous at the region where the pinnules are attached. In addition to the stiff acicular hairs the leaf lamina bears sparse uniseriate thin-walled light-brown multicellular club-shaped hairs in all the genera (Fig. 5 N, O). These are often 4—6 cells long, with the terminal cell slightly swollen, but apparently non-glandular.

### Sori and Sporangia

Sori are borne on the lower surface of the ultimate pinnules and are superficial over the veinlets a little below their apices. A conspicuous indusium is found in all the genera. The indusium is a thin, ovate, scale-like flap attached by a broad base to the posterior side of the sorus in *Acrophorus* (Fig. 6 A). When young, it covers the sorus, but is later pushed backwards by the developing sporangia. It is one cell thick (except at the base) and has a flabellate outer margin. In *Diacalpe* (Fig. 6 B) and *Lithostegia* the indusium covers the young globose sorus completely and is attached all around the short cylindrical stalk on which the sorus is borne. It is one cell thick, chlorophyllous when young and becoming dark, glossy and shining towards maturity. As the sporangia mature, they force open the indusial cover from top downwards tearing it up irregularly into a few scale-like valves which are usually persistent. In *Peranema* (Fig. 6 C, D) the entire sorus is borne over an elongated cylindrical stalk (NAYAR & KAUR 1963). The indusium is zygomorphic, nearly ovoid and covering the sorus, with the narrower end tilted downwards and facing the margin of the lamina. It is attached to the stalk towards the middle of the broader end and possesses a narrow, slit-like, transverse opening on the narrower end, close to the stalk. The indusium is one cell thick and green when young, ultimately becoming nearly black and shining. As in *Diacalpe* it breaks open irregularly into a few scale-like valves to release the sporangia. In all the genera the sorus is supplied by a vascular strand originating as a superficial branch of the foliar vein. In *Acrophorus* the vascular supply is inconspicuous, but in *Peranema* it is a cylindrical, thick vascular strand forming a central shaft in the elongated stalk of the sorus.

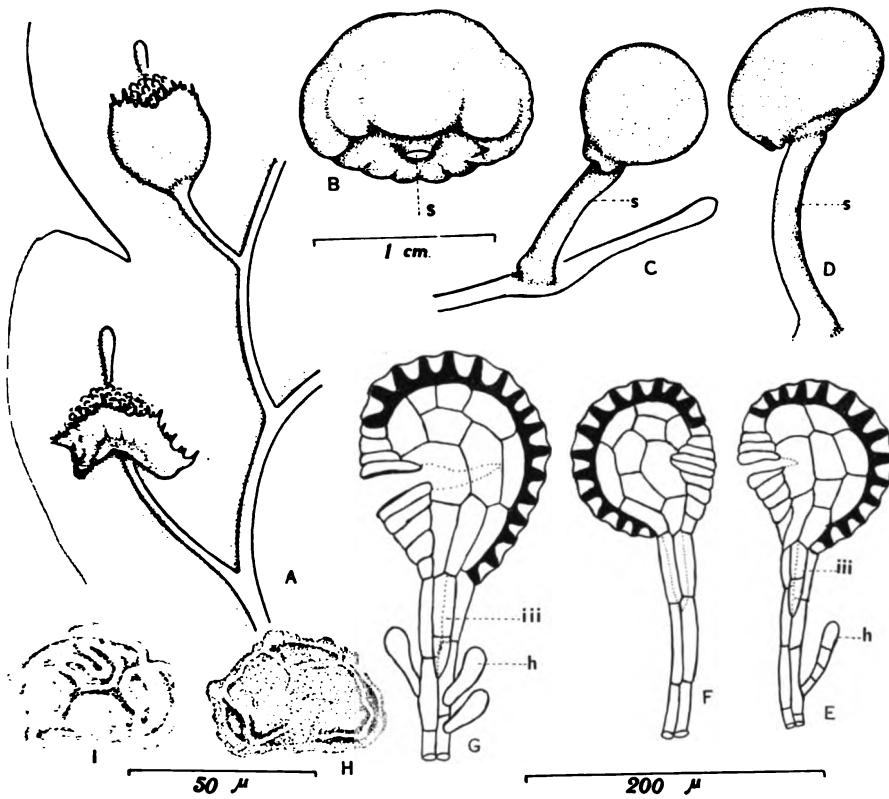


Fig. 6. Reproductive organs (h: hair, s: stalk, iii: 3rd row of stalk cells). — A: Sori of *A. stipellatus* (the lower one mature with the indusium reflexed). B: Unopened but nearly mature sorus of *D. aspidioides* showing the basal attachment. C, D: stalked sorus of *P. cyatheoides*. E-G: Lateral view of sporangia of *A. stipellatus* (E), *P. cyatheoides* (F) and *D. aspidioides* (G). H, I: Lateral view of spores of *A. stipellatus* (H) and *D. aspidioides* (I).

The sporangia (Fig. 6 E-G) are typically of the common leptosporangiate type in all the genera, possessing a lens-shaped capsule and a slender elongated stalk. The annulus consists of 10–14 (up to 17) highly indurated cells and extends nearly  $\frac{2}{3}$  the circumference of the capsule abutting on the stalk on one side. The stomium is well developed, and the capsule wall is composed of a few elongated cells having a rather regular outline with nearly straight side walls. The sporangial stalk is 4–5 cells long and is 2 cells thick when young, the rows being continuous with the annular ring of the capsule. During sporangial development, a short third row of stalk cells (usually one or two cells

long and extending less than half the length of the stalk) is formed secondarily from the basal wall cell on one side of the sporangial capsule. One of the basal wall cells protrude downwards and develop into the 3rd row. A few unicellular, highly vacuolated, club-shaped or balloon-like, thin-walled hairs are borne by the lower stalk cells in all genera except *Peranema*. In *Acrophorus* hairs are few, elongated and in many cases 2—4 cells long. Hairs similar to the sporangial ones are found sparsely distributed between the sporangia.

### Discussion

The taxonomic history of *Acrophorus*, *Dicalpe*, *Lithostegia* and *Peranema* has already been presented in an earlier communication (NAYAR & KAUR 1963). These four genera of tropical ferns agree generally in frond form, habit and habitat, but differ in details of their soral morphology; even in soral morphology *Dicalpe*, *Lithostegia* and *Peranema* exhibit little difference among them, all possessing globose superficial sori covered by leathery basally attached indusia enveloping the sorus and splitting open irregularly at maturity. Also they agree in several fundamental features of external morphology, anatomy of the different organs, organisation of the stelar cylinder of rhizome, morphology of the spores and prothalli as well as cytology, that it appears unnecessary to recognize them as distinct genera. A genus is commonly accepted as a convenient group of related species, and relationships are commonly judged by total morphological comparison. The preponderance of similarities between *Dicalpe*, *Lithostegia* and *Peranema*, thus suggests close relationship, and, without violence to nature, it appears feasible to combine them as we have already suggested earlier (NAYAR & KAUR 1963). Taxonomic characterization of the combined genus (*Peranema* Don emend. Nayar et Kaur) is already presented (NAYAR & KAUR 1964 c).<sup>2</sup>

As to the affinities, most of the early workers regarded *Peranema* and *Dicalpe* as intermediate between the *Cyatheaceae* and the *Aspidiaceae*. BOWER (1928) considers them along with *Acrophorus* as a connecting link between the cyatheoid and the aspidioid ferns. The possession of

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<sup>2</sup> The following new combinations are suggested for species other than those included in this study: — *Peranema annamensis* (Tagawa) Nayar et Kaur comb. nov. (*Dicalpe annamensis* Tagawa 1950), *P. christensenae* (Ching) Nayar et Kaur comb. nov. (*Dicalpe christensenae* Ching 1949), *P. omeiensis* (Ching) Nayar et Kaur comb. nov. (*Dicalpe omeiensis* Ching 1949).

multicellular prothallial hairs, as reported by SCHLUMBERGER (1911) and their supposed resemblance to the characteristic "bristle-like" hairs (STOKEY 1930) of the *Cyatheaceae*, the presence of divided opercular cells of antheridia (SCHLUMBERGER 1911) in *Peranema* as well as the cyatheoid ferns, and the shape and probable evolution of the indusium in these ferns from the cup-shaped indusia of some of the *Cyatheaceae*, appear to have been the main considerations in ascribing a cyatheoid affinity to *Peranema* and *Diacalpe*. The large finely dissected leaves, bearing prominent superficial sori, might also have contributed to the superficial similarity to the cyatheoid ferns.

The sori of the cyatheoid ferns are morphologically much variable, and in some species bear a close resemblance to the sori of *Acrophorus*, *Diacalpe*, *Peranema* and *Lithostegia*. Other than this, it appears that there is morphologically little in common between these genera and the cyatheoid ferns to support a suggestion of any close relationship. The prothalli of *Acrophorus*, *Diacalpe*, *Lithostegia* and *Peranema* are strictly of the aspidioid type — cordate, bearing profuse unicellular papillate hairs (marginal and superficial), and following a pattern of development common in most *Aspidiaceae* (like the tectarioid ferns, the polystichoid ferns, etc.). Even the range of variation in the developmental history of the prothallus, is the same as in the polystichoid and tectarioid ferns (unpublished data). The cyatheoid prothallus, though of the cordate type, is markedly different in its developmental history as well as in the nature of its trichomes (STOKEY 1930). The characteristic bristle-like multicellular hairs, developing from special initials on the prothalli of the *Cyatheaceae*, have been held to be similar to the multicellular prothallial hairs reported by SCHLUMBERGER (1911) in *Peranema*. However, the present studies, as also detailed studies of DAVIE (1912, 1916) on *Diacalpe* and *Peranema*, have failed to corroborate SCHLUMBERGER's report: only the common aspidioid type of unicellular papillate hairs are borne by the prothalli of these ferns. Also, the supposed similarity of the divided opercular cell of the antheridium in these ferns and some of the *Cyatheaceae*, appear to be based on incomplete evidence. Under certain conditions of development the opercular cell in these ferns may be divided, but this is not of common occurrence. Occasional divided opercular cells are reported in several ferns, by no means closely related, and this feature seems to have little significance in assessing phylogeny and relationships. The spores of the *Cyatheaceae* are of the tetrahedral type devoid of any distinct perine (NAYAR 1964, HOLTUM & SEN 1961) whereas in *Peranema*, etc., they



are strictly of the bilateral type with a characteristic perine, closely resembling the spores of other *Aspidiaceae* (NAYAR & DEVI 1964).

The dermal appendages of the *Cyatheaceae* (HOLTUM 1957, HOLTUM & SEN 1961) are characteristic, the paleae being either of the flabelloid type or setiferous and terminated by an elongated, thick-walled, stiff, unicellular, acicular hair; the paleae of *Peranema*, etc., are distinctly different from these, and are similar to the paleae of the other *Aspidiaceae*. The superficial hairs on the paleae of *Peranema* are interesting in that superficial appendages on the paleae are unusual among ferns. Superficial hairs similar to those of the *Cyatheaceae* are reported in the thelypteridoid ferns, and this is often held as indicative of the cyatheoid affinity of this group. However, we have noticed superficial hairs quite similar to those of *Peranema* in quite unrelated genera like *Pyrrosia* (*Platyneriaceae*) and *Arthromeris* (*Polypodiaceae*).

The characteristic, stiff, multicellular, foliar hairs of *Acrophorus*, *Diacalpe*, *Lithostegia* and *Peranema* are interesting in that hairs somewhat similar to these occur in some of the aspidiaceous ferns (like some of the tectarioid group). They, however, do not indicate any resemblance to the foliar trichomes of the cyatheoid ferns. Many of the *Cyatheaceae*, as pointed out recently by HOLTUM & SEN (1961), possess characteristic 'cubical cells' in the ground tissue and sometimes 'tangential cells' associated with phloem. Also, the meristemes possess a sclerenchymatous sheath. *Acrophorus*, *Diacalpe*, *Lithostegia* and *Peranema* lack these features, but like most other aspidiaceous ferns (the tectarioids, the polystichoids) possess slender strands of sclerenchyma scattered in the ground tissue. The tendency for the root traces to be associated with the leaf traces is another feature which these ferns have in common with tectarioid and polystichoid ferns. The chromosome count  $n=41$  (VERMA 1958, MEHRA & SINGH 1955), typical of the aspidiaceous stock, is another important character in support of the aspidiaceous affinity of these genera of ferns. The basic chromosome number in the *Cyatheaceae* appears to be  $n=69$ . (ABRAHAM *et al* 1962, BROWNLIE 1954, 1958, 1961, MANTON & SLEDGE 1954, MEHRA & SINGH 1955).

On balance the genera *Acrophorus*, *Diacalpe*, *Lithostegia* and *Peranema* appear to be morphologically unrelated to the cyatheoid stock, but closely allied to the aspidioid stock, justifying the position allotted to them by COPELAND (1947).

### Acknowledgement

We are indebted to the Director, National Botanic Gardens, Lucknow, for his encouragements.

### Summary

The spores of the 4 species (*Acrophorus stipellatus*, *Diacalpe aspidioides*, *Lithostegia foeniculacea* and *Peranema cyatheoides*) studied are monolete, bilateral and with a smooth, thin exine enveloped by a loose granulose perine wrinkled into characteristic convoluted folds. The mature prothallus is of the cordate type, bearing profuse unicellular papillate hairs both on the margin and surfaces. The prothallus develops from a uniseriate germfilament, the anterior region of which develops a prothallial plate by longitudinal divisions in the terminal and the penultimate cells. A terminal hair is usually developed either before or after plate formation is initiated. An obconical meristematic cell is usually developed in one of the anterior cells of the prothallial plate and is eventually replaced by a multicellular meristem: several thalli, however, omit an apical-cell-stage. Young thalli are usually profusely hairy.

The rhizome is short, erect and clothed by basally-attached, clathrate paleae bearing marginal (also superficial in *P. cyatheoides*), club-shaped, unicellular hairs, and terminated by a swollen, probably glandular cell. Unicellular club-shaped hairs occur mixed with paleae. The ground tissue of the rhizome is parenchymatous, with scattered, slender strands of highly thick-walled sclerenchyma. The vascular cylinder is dictyostelic with large, closely placed leaf gaps arranged in 3 or 4 spirals around the cylinder. Each leaf is supplied by 5—8 slender vascular bundles. Root traces are mostly associated with the leaf-trace bundles. The leaves are decompound with free pinnately-branched veins in the ultimate pinnules. The stipe has a peripheral sclerenchymatous sheath, which is hypodermal and gradually merging with the inner ground tissue in *Diacalpe* and *Lithostegia*, and cortical and sharply delimited in *Acrophorus* and *Peranema*. The leaf lamina bears multicellular hairs on both surfaces, and has an undifferentiated mesophyll. The sorus is superficial on the veins and is protected by a basally attached indusium which is flap-like in *Acrophorus* and globose (enveloping the sorus, and splitting open at maturity) in the others; in *Peranema* the sorus is borne on an elongated cylindrical stalk and the indusium has a slit-like lateral opening. The sporangia are of the common leptosporangiate type with the stalk composed of three rows of cells; a few unicellular (sometimes 2—4 cells long in *Acrophorus*) hairs are borne on the stalk.

It is concluded that there is little justification in regarding *Diacalpe*, *Lithostegia* and *Peranema* as separate genera; they are better merged under *Peranema* Don emend. Nayar & Kaur. *Peranema* as well as *Acrophorus* are evidently of aspidioid affinity; there is little morphological evidence to support a cyatheoid ancestry for these ferns.

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## **Meiotic Chromosome Numbers in Some Vascular Plants of Indus Delta II.**

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### **Introduction**

This investigation is a further contribution to the previous work of BAQUAR et al. (1965) on the plants of Indus delta. This area provides a good opportunity for cyto-taxonomic studies of the virgin endemic flora because of the presence of several kinds of habitat such as tidal swamps, sandy sea shore, saline and sandy land, dry and sandy region, low arid rocky and stony hillocks and cultivated areas. The present paper is second in a series designed to study the evolutionary course followed by the plants of local origin and to establish their genom pattern besides range of polyploidy occurring in endemic flora as this region has not been explored as yet. In this work chromosome counts for 20 indigenous species distributed over 12 families have been recorded.

### **Material and Method**

Chromosome counts were made from pollen mother cell squashes. Buds, collected in the field from the plants growing in their natural environment were fixed in a solution of 6 parts alcohol: 3 parts chloroform: 1 part glacial acetic acid and were preserved in 75 % alcohol, till a convenient time to make temporary slides. Anthers were squashed in aceto-carmin. Camera lucida drawings were made at a magnification of approximately 2000  $\times$ . For nomenclature and identification of plants HOOKER's "Flora of British India" (1872—1897) was consulted. Voucher specimens are deposited in the Herbarium of Central Laboratories, Pakistan Council of Scientific and Industrial Research, Pakistan.

## Results

### *Capparidaceae*

#### 1. *Capparis cartilaginia* Decne. $n=10$

This species does not appear to have been studied before. The gametic number  $n=10$  is a new record. The somatic numbers 18, 30, 38, 40 and ca 84 reported for other allied species of *Capparis* seem to represent a case of aneuploidy if 18 and 38 are not the counting error for 20 and 40 respectively. The basic number for this genus as recorded in DARLINGTON & WYLIE (1955) shows  $n=9$ , 10 and  $n_2=19$ . Our investigation suggests 10 to be the basic number.

#### 2. *Gynandropsis gynandra* (L.) Briq. (Syn. *G. pentaphylla* DC.) $n=17$

This is a very common tropical herb distributed almost throughout West Pakistan. Previous somatic counts are 30 (SUGUIRA 1937), 32 (RAO 1936) and 34 (RAGHAVAN 1938). These counts suggest the presence of aneuploidy. Our report of  $n=17$  is in accordance with that of RAGHAVAN. The basic number for this species is yet not known with certainty.

### *Malvaceae*

#### 3. *Abutilon graveolens* Wight et Arn. $n=18$

Chromosome count for *A. graveolens* has not been reported before but for other *Abutilon* species there are previous somatic records of 14, 16, 36 and 42 chromosomes. The gametic number  $n=18$  is a new record for this species which falls in line with ROY & SINHA (1961) who reported  $2n=36$  for *A. indicum*. The basic numbers as reported in DARLINGTON & WYLIE (1955) are 7 and 8. Our investigation suggests the possibility of 9 being one of the basic numbers apart from the two mentioned above. However, *Abutilon* needs careful investigation for polyploidal analysis.

### *Tiliaceae*

#### 4. *Corchorus trilocularis* L. $n=7$

A common annual herb having elongated 3-angled capsules with entire beak. It is distributed almost throughout West Pakistan. MUKERJEE (1952) and RAO & DUTTA (1953) reported  $2n=14$  which is confirmed by our gametic record of 7 chromosomes.

### 5. *Corchorus tridens* L. $n=7$

This species is distinguished from *C. trilocularis* in having elongate cylindric capsules which end in 3-fid terminating points. It is quite variable in size and is found growing in waste shady places. Previous counts of  $2n=14$  reported by MUKERJEE (1952) and ISLAM & QAIYUM (1961) agree to our finding of  $n=7$ .

## *Papilionaceae*

### 6. *Indigofera oblongifolia* Forsk. (Syn. *I. paucifolia* Delile) $n=7$

A low unarmed shrub with copious woody branches. It is distributed throughout the dry arid region of West Pakistan specially in plains of Sind and Indus delta. Chromosome count for this species has not been reported before. Gametic number  $n=7$  is a new record. The basic numbers recorded for the genus *Indigofera* are 6, 7 and 8.

### 7. *Astragalus fatmensis* Hochst. ex Blatter (Syn. *A. prolixus* Sieb.) $n=8$

The basic number  $n=8$  is a new record as this species does not appear to have been studied before. The somatic numbers reported by various workers for other allied species of *Astragalus* from the old world are 16, 30, 32, 48, ca 56, 64, 72 and 96 which, except 30, are a multiple of 8 thus confirming 8 to be the basic number. It is difficult to ascertain whether  $2n=30$ , reported for *A. baeticus* L. by TSCHENCHOW (1935) and LEDINGHAM (1960) displays a case of aneuploidy or a counting error for 32. Some American species of *Astragalus* have been reported to have  $2n=22$ , 24 and 36 chromosomes.

### 8. *Rhynchosia minima* (L.) DC. $n=11$

A predominantly twining or wide-trailing annual herb extending throughout the plains of Sind and Indus delta ascending up to a height of 4000 ft. Our report of  $n=11$  is a confirmation of the previous finding of  $2n=22$  by SENN (1938) and MIEGE (1960) and  $n=11$  by TURNER (1956 b).

### 9. *Cassia angustifolia* Vahl $n=14$

Very frequently occurring perennial undershrub with 10—16 oblong lanceolate acute leaflets and nearly straight oblong pods without crest.

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Fig. 1. a. *Capparis cartilaginia*  $n=10$  (Met II), b. *Gynandropsis gynandra*  $n=17$  (Met II), c. *Abutilon graveolens*  $n=18$  (Met I), d. *Corchorus trilocularis*  $n=7$  (Met I), e. *Corchorus tridens*  $n=7$  (Met I), f. *Astragalus prolixus*  $n=8$  (Met II), g. *Indigofera paucifolia*  $n=7$  (Met I), h. *Rhynchosia minima*  $n=11$  (Met I), i. *Cassia obovata*



n=14 (Met I), j. *Cassia angustifolia* n=14 (Met I), k. *Cassia holosericea* n=14 (Met I), l. *Prosopis glandulosa* n=14 (Met I), m. *Limeum indicum* n=9 (Met I), n. *Ipomoea rumicifolia* n=15 (Met I), o. *Capsicum annum* n=12 (Met I), p. *Ruellia patula* n=16 (Late diakinesis), q. *Blepharis sindica* n=13 (Met II), r. *Digera arvensis* n=9 (Met I), s. *Atriplex stocksii* n=18 (Met I), t. *Haloxylon recurvum* n=11 (Met I).



Our finding of  $n=14$  is in accordance with that of SAMPATH & RAMANATHAN (1949) and FRAHM-LELIVELD (1960) who reported 28 as somatic number. MEHRA & SOBTI (1955) on the contrary reported a gametic number of 13 which is different to our finding.

10. *Cassia obovata* Collad. (Syn. *C. obtusa* Roxb.)  $n=14$

This species differs from *C. angustifolia* in having characteristic obovate-oblong leaflets and flat oblong pods narrowed suddenly at both ends, with a crest on the middle of the valve opposite each seed. Our record of the gametic number of 14 is in line with the previous report of  $2n=28$  by RAMANATHAN (1950) and FRAHM-LELIVELD (1957).

11. *Cassia holosericea* Fresen.  $n=14$

*C. holosericea* resembles to a great extent *C. obovata* in general habitat specially leaf shape, but is distinguished in pod character which is without crest. This species does not appear to have been studied before, hence the gametic number of  $n=14$  is a new record.

### Mimosaceae

12 *Prosopis glandulosa* Torr.  $n=14$

HOOKE in the Flora of British India (1879) reported only two species, namely: *Prosopis specigera* L. and *P. stephaniana* Kunth from the Indo-Pakistan Sub-continent out of which the first mentioned one was reported from the area under present study. A careful observation of the genus, which is under investigation, reveals some marked differential characters which identify the material from this area to *P. specigera* L., *P. juliflora* DC. and *P. glandulosa* Torr. All these species occur predominantly throughout the dry, sandy and gravelly expanse of Sind and Indus delta. The chromosome count for *P. glandulosa* as reported by RAMANATHAN is  $2n=26$  and for other allied species it has been reported to be 26, 28, 52, 56 and ca 112 by various workers. This variety of chromosome numbers suggests the presence of aneuploidy in this genus. CHERUBINI (1954) recorded  $2n=28$  for *P. juliflora* var. *glandulosa*.

### Ficoideae (= Aizoaceae)

13. *Limeum indicum* Stocks ex T. Anders.  $n=9$

The genus *Limeum* is represented by a single species, *L. indicum*, in the Indo-Pakistan Sub-continent. It is a prostrate, glandular-puberu-

lous herb and is quite common in sandy and rocky areas. Our investigation of a gametic number  $n=9$  is in accordance with the recent report of NARAYANA & JAIN (1962).

### *Convolvulaceae*

#### 14. *Ipomoea rumicifolia* Choisy $n=15$

This species has not been investigated before. The gametic number  $n=15$  is a new record. The somatic counts reported for other *Ipomoea* species are 30, 60 and 90, on the basis of which DARLINGTON & WYLIE (1955) suggested 15 to be the basic number while LÖVE & LÖVE (1961) suggest 5 as the base number. It is difficult to say whether our material lies at the haploid or triploid level.

### *Solanaceae*

#### 15. *Capsicum annuum* L. (Syn. *C. frutescens* L.) $n=12$

*Capsicum annuum* has been studied by various workers as PAL et al. (1941), SINHA (1950), PICHENOT (1959) and OHTA (1962 a, b) who reported  $2n=24$ , while PAL et al. also recorded 36 and 48 as somatic number. Our report of a gametic number 12 is in line with the previous results. The basic number for this species is 6 which suggests our specimen to be a diploid one.

### *Acanthaceae*

#### 16. *Ruellia patula* Jacq. $n=16$

This is quite a common species in the area and its cytology seems to have been studied for the first time by the present authors. The gametic number  $n=16$  is new record for this species. Previous somatic counts reported for other allied taxa show 32, 34 and 36 chromosomes which suggests the presence of aneuploidy in this genus.

#### 17. *Blepharis sindica* T. Anders. $n=13$

A basic number  $n=13$  is a new record as this species does not appear to have been studied before. This is a very common species, with toothed or subspinescent leaves, 6—10 cm long quadrifarious heads, and divaricate lanceolate, prickly-tipped bracts. It is found invariably on dry and stony hillocks of this region. MIEGE (1962) reported  $2n=24$  for *B. linearifolia* Pers. and  $2n=30$  for *B. madraspatensis* Heyne. These

counts do not fall in line with our findings thus suggesting the existence of aneuploidy in this genus. The basic number for this species is not yet known.

#### *Amaranthaceae*

18. *Digera arvensis* Forsk.  $n=9$

The genus *Digera* is represented by a single species, *D. arvensis*, which is a very common annual herb, sometimes becoming perennial. It is found almost throughout West Pakistan, extending up to Arabia and N. Africa. PURI & SINGH (1935) reported  $2n=12$ , while MALIK (1960) recorded  $n=9$  which is confirmed by our investigation. The specimen investigated by us appears to be a triploid as the basic number reported for this species is 6.

#### *Chenopodiaceae*

19. *Atriplex stocksii* Boiss.  $n=18$

A very low common undershrub with whitish, woody, prostrate or suberect branches. It is found growing in sand or salt marsh along the coastal region of West Pakistan. This species has not been cytologically studied before. Previous counts for various other species of *Atriplex* show 18, 36 and 72 to be the somatic number while a gametic report of  $n=9$  exists for *A. parviflora* by LARSEN (1960) which suggests 9 to be the basic number.

20. *Haloxylon recurvum* Bunge ex Boiss.  $n=11$

This is a very predominantly occurring shrub of salt range in Sind and Indus delta, with blackish long spreading branches ending in spikes about 6—12 cm long. Apparently no record exists in the literature on a cytological study of this genus from this region. The gametic number 11 is a new record for this species.

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#### Summary

This work, which is a continuation of previous report, presents the chromosome counts for 20 indigenous species of Indus delta. These include new records for 10 species (marked with\*) while the remaining 10 are the confir-

mation of previous counts. The cytomorphological aberrations displayed by some of these species will be dealt with separately.

* <i>Capparis cartilaginia</i> Decne. ....	n=10
<i>Gynandropsis gynandra</i> (L.) Briq. ....	n=17
* <i>Abutilon graveolens</i> Wight et Arn. ....	n=18
<i>Corchorus trilocularis</i> L. ....	n= 7
<i>Corchorus tridens</i> L. ....	n= 7
* <i>Indigofera paucifolia</i> Delile. ....	n= 7
* <i>Astragalus prolixus</i> Sieb. ....	n= 8
<i>Rhynchosia minima</i> (L.) DC. ....	n=11
<i>Cassia angustifolia</i> Vahl ....	n=14
<i>Cassia obovata</i> Collad. ....	n=14
* <i>Cassia holosericea</i> Fresen. ....	n=14
<i>Prosopis glandulosa</i> Torr. ....	n=14
<i>Limeum indicum</i> Stocks ex T. Anders. ....	n= 9
* <i>Ipomoea rumicifolia</i> Choisy ....	n=15
<i>Capsicum annuum</i> L. ....	n=12
* <i>Ruellia patula</i> Jacq. ....	n=16
* <i>Blepharis sindica</i> T. Anders. ....	n=13
<i>Digera arvensis</i> Forsk. ....	n= 9
* <i>Atriplex stocksii</i> Boiss. ....	n=18
* <i>Haloxylon recurvum</i> Bunge ex Boiss. ....	n=11

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# On *Eudarluca caricis* (Fr.) O. Eriks., comb. nov., a Cosmopolitan Urediniculous Pyrenomycete

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## Introduction

*Darluca filum* (Biv.-Bern. ex Fr.) Cast. is a well-known cosmopolitan parasite on rusts. It belongs to *Sphaeropsidales* in *Fungi imperfecti*. Its perfect state has hitherto been known as *Eudarluca australis* Speg. It has never been recorded from Europe, but in 1962 I collected this state at two separate localities in Sweden. Being a fungus that catches the eye, it seemed reasonable to conclude that it most probably had been collected several times in Europe, but that all collections were published and/or preserved under some name or names not assigned to the perfect state of *E. australis* before. This surmise could be verified. I found several earlier and later synonyms of this species, and the correct name now has to be *Eudarluca caricis* (Fr.) O. Eriks. comb. nov. (Basionym: *Sphaeria caricis* Fr. in *Systema mycologicum* 2 (2): 435 (1823); list of synonyms on p. 35). Our knowledge of this species has been very incomplete and scattered. In this paper, which is no monograph on *E. caricis*, I have merely tried to bring together the most important new or already known facts on the taxonomy, nomenclature and distribution of this species.

## Historical Survey

The literature on the imperfect states needs some brief introductory words. The literature on the perfect state, which turned out to be more extensive than was first expected, is treated more in detail. As mentioned above, this state has been known as *Eudarluca australis* Speg. It may be appropriate first to review the literature on this basionym

and then to deal with the other basionyms in chronological order. None of the latter was earlier assigned to the perfect state of *Darluca filum*. In most cases these species were not even known to be uredinicolous. Having been so misinterpreted, almost any information in the literature on the perfect state is of interest and needs some comments. Thus, in this special case, I think there may be reasons for a fuller historical treatment.

### The Imperfect States

The literature on the macroconidial state, *Darluca filum*, is large for several reasons. Its ecology is interesting, as very few fungi are known to be parasites on rusts. It is a common and widespread fungus. Moreover, as it is easy to recognize, macroscopically (fig. 4 d) as well as microscopically, it has very often been collected. Hence it is also often met with in lists of micromycetes from all over the world. There are several more comprehensive studies on this fungus too. Its physiology was studied by, e.g., KEENER (1933, p. 130) and NICOLÁS & VILLANUEVA (1965, p. 782). KEENER (1934, p. 475) also studied its biological specialization. Its possible economic importance was discussed by some authors and experiments are under way to test its utility for control of rust (PELHATE 1961, p. 32, SEBESTA 1963, p. 159). Some papers of taxonomical interest are mentioned on p. 52.

This fungus was described in 1815 by BIVONA-BERNARDI (p. 12, tab. 3: 3) under the name *Sphaeria filum*. Two of the hosts given for this species are rusts. In 1823 FRIES in *Systema mycologicum* (p. 547) transferred *S. filum* to the genus *Phoma*. By this the epithet "*filum*" is validly published. In 1845 CASTAGNE (p. 53) established the new genus *Darluca* for a fungus, which he had sent to other mycologists under the MS name *Darluca vagans* Cast. He considered *Sphaeria filum* Biv.-Bern. a synonym of his species. The legitimate epithet is however "*filum*" and the epithet "*vagans*" is superfluous. An original collection of "*Darluca vagans* Cast." (UPS) differs in one respect from other collections of *D. filum* I have seen. It yielded plenty of 3-septate conidia in addition to 1-septate. Normally the conidia in *D. filum* are only 1-septate. CASTAGNE correctly figured the conidia as 1—3-septate (op. cit., pl. VIII). His material is probably over-ripe.

When SPEGAZZINI in 1908 described *Eudarluca australis*, he assumed it to be the perfect state of a *Darluca*. There were several species in this genus, but most mycologists regarded it as more or less self-evident that

this state is *D. filum*. The connection between *Darluca* and *Eudarluca* was not proved experimentally until 1951 by KEENER (p. 86—87). His paper is of interest also in another respect. It gives (l.c.) the first and as far as I know the only record of a microconidial state in *Eudarluca*, but the connection was not confirmed in any cultural experiment. There are some species commonly assigned to *Phyllosticta* which are uredinicolous. The fungus observed by KEENER may perhaps be identical with one (or several) of them. This possible microconidial state is also dealt with on p. 51.

### The Perfect State

The synonymy of the perfect state is as follows (references to pages in this chapter are put in brackets):

#### *Eudarluca caricis* (Fr.) O. Eriks.

- ≡ *Sphaeria caricis* Fr., 1823. (p. 39)
- ≡ *Sphaeropsis caricis* (Fr.) Kickx, 1867.
- ≡ *Dothidea caricis* (Fr.) Cooke, 1871.
- ≡ *Phyllachora caricis* (Fr.) Sacc., 1883.
- ≡ *Phoma caricis* (Fr.) Sacc., 1884.
- ≡ *Macrophoma caricis* (Fr.) Berl. & Vogl., 1886.
- = *Dothidea genistalis* Pers. ex Fr., 1823. (p. 43)
- ≡ *Sphaeria genistalis* Pers. in litt., vide Moug. & Nestl., 1815.
- ≡ *Darluca genistalis* (Pers. ex Fr.) Sacc., 1880.
- = *Sphaeria caricis* Fr. var. *depauperata* Desm., 184?—1851.
- = *Darluca filum* (Biv.-Bern. ex Fr.) Cast. var. *dothideaeformis* Fuck., 1870. (p. 45)
- ≡ *Darluca genistalis* (Pers. ex Fr.) Sacc. var. *dothideaeformis* (Fuck.) Sacc., 1880.
- = *Darluca filum* (Biv.-Bern. ex Fr.) Cast. var. *stromatica* Fuck., 1868. (p. 45)
- ≡ *Darluca genistalis* (Pers. ex Fr.) Sacc. var. *stromatica* (Fuck.) Sacc., 1880.
- = *Dothidella appendiculata* deLacr. ex Br. & Har., 1891. (p. 47)
- ≡ *Dothidea appendiculata* deLacr. (nom. nud.), 1859.
- ≡ *Diplochorella appendiculata* (deLacr. ex Br. & Har.) Theiss. & Syd., 1915.
- ?? = *Sphaerella pucciniophila* Sacc. & Syd. in Sacc., 1899. (p. 48)
- ≡ *Sphaerella parasitica* Fautr. in Roum., 1890 (non *Sphaerella parasitica* Wint., 1886).
- = *Eudarluca australis* Speg., 1908. (p. 36)
- ! = *Didymella darluciphila* Speg., 1909. (p. 49)



- ? = *Didymella kariana* Sacc., 1914. (p. 49)  
 = *Leptosphaeria nigrificans* Bub. & Wróbl. in Bub., 1916 a. (p. 49)  
 = *Myrmaecium cannae* Dearn. & Barth. in Dearn., 1917. (p. 50)  
 = *Uleodothis paspali* Stev., 1924. (p. 50)  
 = *Eudarluca indica* Ramak., 1951. (p. 51)

### ***Eudarluca australis* Speg.**

In 1908 SPEGAZZINI (p. 22) established the genus *Eudarluca* for a new pyrenomycete in the uredosori on *Canna* sp. (cult.) in the Botanical Garden in São Paulo (Brazil). The genus was described as follows:

"Perithecia e globoso lenticularia parenchymatica glabra ostiolata; asci cylindracei paraphysati octospori; sporae cylindraceo-fusoideae hyalinae v. fumosae, 2-septatae.

Genus pulchellum in *Uredinibus* (an, semper?) parasiticum, statum ascophorum *Darlucarum* proferens."

The only species, *Eudarluca australis*, was given the following description:

"*Diag.* Characteribus generis praedita; contextu peritheciolorum fusco fuligineo.

*Hab.* In *Uredine cannae* Wint. ad folia viva *Cannae* cujusdam in hortis São Paulo.

*Obs.* Perithecia 3—5-gregaria erumpentia nigra glabra (80—100  $\mu$  diam.) impresso-ostiolata, coriacea, contextu circa ostiolum atro opaco ambitu pellucido minute denseque parenchymatico fuligineo (noncyaneo!); asci antice obtuse rotundati crassiusculeque tunicati, postice breviter cuneati in pedicello brevissimo crassiusculoque producti, paraphysibus filiformibus longioribus obvallati (60  $\mu$  = 10  $\mu$ ), octospori; sporae oblique distichae (16—20 = 4  $\mu$ ) ad septa lenissime constrictulae, loculo medio saepius leniter tumidiore, primo hyalinae serius fumosae, utrinque acutiuscule rotundatae rectae v. lenissime inaequilaterales."

His figure (op. cit., fig. E 1—6) gives a good idea about its habit and morphology. The most remarkable feature is the 2-septate ascospores. Ascospores with such a septation are on the whole very rare. Figs. 1 c and 4 b.

In 1926 SYDOW (p. 360) recorded two collections of *E. australis* from Costa Rica and described them carefully (fig. 3 c). He also studied an isotype of *E. australis*, which he, however, found to be over-ripe. Although his own collections only yielded 1-septate ascospores he considered them conspecific with this species. According to SYDOW, SPE-

GAZZINI had made an observational mistake and consequently he felt it necessary to redescribe the genus *Eudarluc*a. His description runs:

„Stromata in den Uredolagern von Rostpilzen parasitierend, durch ein meist sehr hell gefärbtes  $\pm$  parenchymatisches, stark hervorbrechendes Basalstroma dem Mesophyll eingewachsen. Lokuli einzeln, meist zentral, seltener in geringer Zahl in Gesellschaft der zugehörigen *Darluc*a-Konidien-lokuli dem Stroma mehr oder weniger tief eingewachsen, völlig geschlossen, ohne Ostiolum, durch einen rundlich eckigen Porus sich öffnend, mit zeimlich dicker, schwarzbrauner dothideal-parenchymatischer Wand. Aszi zylindrisch keulig oder fast zylindrisch, derbwandig, 8-sporig, fast sitzend. Sporen länglich spindelförmig, 2-zellig, in völlig reifem Zustande vielleicht 4-zellig, meist gerade, hyalin, mittel-gross. Paraphysoiden sehr spärlich, undeutlich faserig zellig.“.

This emendation of the genus has essentially been accepted by later authors. It is further discussed on p. 54.

In 1927 PETRAK (p. 301—302) after having examined type material of *Myrmaecium cannae* Dearn. & Barth. from Costa Rica stated that this species was a synonym of *E. australis*.

In 1929 PETRAK (p. 333) claimed that *Uleodothis paspali* Stevens from British Guiana was conspecific with *E. australis*.

In 1929 SYDOW (p. 426) reported a find of *E. australis* from China. This collection yielded 3-septate, pale honey-yellow ascospores and should, according to SYDOW, represent the fully mature state of *E. australis*.

In 1930 SYDOW (p. 71) recorded two collections of *E. australis* from Venezuela. One of them was issued in his "Fungi exotici exsiccati" as no. 807.

In 1932 PETRAK & CIFERRI (p. 190) recorded two collections of *E. australis* from the Dominic Republic.

In 1934 KEENER studied the biological specialization in *D. filum*. He isolated conidia from 11 collections of this fungus. KEENER (p. 477) also found an ascomycete on *Puccinia obscura* (on *Juncoides campestre*) and on *Puccinia Peckii* (on *Carex normalis*), in Pennsylvania, which he believed might be the perfect state of *D. filum*. Ascospores from these collections were isolated and used in his experiments.

In 1939 SYDOW (p. 378) recorded *E. australis* from Equador.

In 1941 DOIDGE (p. 208) recorded three collections of *E. australis* from South Africa. From her detailed description the following may be extracted: "Stromata developing in the uredo-sori of rust fungi; basal stroma growing into the mesophyll of the leaf, erumpent, more or less parenchymatous, consisting of light-coloured, thin-walled cells, which,

immediately under the loculi, are often in vertical rows . . . Spores . . . usually with three cross walls of which only the central one is readily distinguishable". DOIDGE was sure that her South African fungus was conspecific with *E. australis*. I have not seen her collections, but probably she is right. These collections seem to agree at least with the stromatic fungus, that was described by, e.g., SYDOW and STEVENS (see above), and that in its turn probably represents *E. australis* (= *E. caricis*) in its normal state of development. DOIDGE also found the imperfect state in an empty or over-ripe condition on the edges of the stromata.

In 1946 HANSFORD (p. 58) claimed that *E. australis* was common in tropical Africa in its perfect as well as its imperfect state. Many later records indicate that he is right. He is wrong, however, when he states *E. australis* to be "apapophysate". Those of HANSFORD's collections which I have seen do not differ in this respect from other collections of the species. Typical pseudoparaphyses are always present. HANSFORD's opinion that *E. australis* is Sphaeriaceous is not correct.

In 1949, when describing the new uredinicolous fungus *Creonecta biparasitica*, PETRAK (p. 258), in passing, stated that this imperfect fungus was mixed with *D. filum* and young pseudothecia of *E. australis*. According to PETRAK, *C. biparasitica* has a stroma of a different type from that in *Darluca-Eudarluca*, and consequently he did not consider this species congeneric with his own species.

In 1949 WALLACE & WALLACE (p. 13 and 18) recorded *E. australis* from Tanganyika on two graminicolous rust species.

In 1951 KEENER (p. 86—87) reported that "culture and histological studies at various intervals over several years disclose that a fungus found colonizing uredinial and telial sori of *Puccinia extensicola oenotherae* (Mont.) Arth., on *Carex* sp. (= *C. straminea*?) at State College, and of *Puccinia obscura* Schroet., on *Luzula* sp. at Shingletown Gap, Pennsylvania, represents an ascus stage (*Eudarluca*) of the rust parasite, *Darluca filum* (Biv.) Castagne". These are probably the very collections that he used in his experiments on the biological specialization in this species already in 1934. He also recorded an immature collection of *E. australis*, observed in 1933 on *Frommea obtusa* (Str.) Arth. (on *Potentilla canadensis* L.) in Pennsylvania. KEENER's paper is of interest in two other respects as mentioned on p. 35.

In 1952 HUGHES (p. 35) recorded *E. australis* from "the Gold Coast". Two of his collections in Herb IMI are from this part of Africa, one from Togo and the other from Ghana.

In 1953 PETRAK (p. 105) recorded two collections of *E. australis* from Florida, U.S.A.

In 1953 in a paper on the rusts of "Nyasaland" (=Malawi), BISBY & WIEHE (p. 2) stated that "*Darluca* is often so abundant, sometimes also in the perfect state *Eudarluca*, that one may have to search to find a few good rust spores".

In 1954 PETRAK (p. 18) reported *E. australis* from North Borneo.

In 1960—1965 *E. australis* was recorded by many mycologists e.g., by JOHNSTON (1960 a, p. 24) from Malaya and (1961, p. 30) from Netherlands New Guinea, by NATTRASS (1961, p. 34) from Kenya, by LEATHER (1962, p. 30) from Jamaica, by PIENING (1962, p. 32) from Ghana, by KRANZ (1963, p. 179) from Guinea, by TARR (1963, p. 17) from Sudan, by KATUMOTO (1964, p. 361) from Japan and by KRANZ (1964, p. 126) from Libya. KATUMOTO obtained the perfect state in a rust infected with *D. filum* after several weeks deposition of the material in the laboratory. The fungus was stromatic and yielded 1-septate spores (op. cit., fig. 2).

### *Sphaeria caricis* Fr.

In 1823 FRIES, in *Systema mycologicum* (p. 435), described the new species *Sphaeria caricis* as follows:

"262. *S. Caricis*, tecta, inaequabilis, confluens, nigra, ex peritheciis prominentibus astomis tuberculosa.

Praecedenti affinis, sed folii parenchyma in stroma non mutatum, perithecia eidem immersa, omnino genuina, globosa, majora sunt, prominentia, inter se distincta, sed epidermide nigrefacta tecta, unde habitus compositus. Raro reperiuntur individua solitaria. In foliis *Caricis Öderi* & c. vere (v.v., etiam a Cel. Kunz. miss.)".

There is one collection in Herb. FRIES (UPS) with the following text: "*Sphaeria Caricis* S.M. — *Car. Öderi*. Fries . .". This is obviously an original collection. The label is written by FRIES himself. His name and the first point after the name is written by him with darker ink on a later occasion. It replaces an earlier text, which has been impossible to decipher.

This collection consists of three fragments of a *Carex* sp. The leaves are heavily infested with fungi. About 50 % of the adaxial surfaces of the leaves are black from a pyrenomycete (fig. 2 a). Some stromata can also be seen on the abaxial surfaces of the leaves, which are ruptured by numerous uredosori of *Puccinia caricina* DC. In some sori the typi-

cal pycnidia of *Darluca filum* are to be found. The stromata are compact and  $\pm$  pseudoparenchymatous. The outer layers are dark brown, while the inner parts consist of pale, thin-walled cells (fig. 2 b). Collapsed uredospores and fragments of the leaf-tissues are enclosed in the stromata (fig. 2 c). There are usually several loculi immersed in each stroma. Only the conical apices of the loculi protrude. Most loculi are immature. The mature ones contain asci and ascospores of exactly the same type as in the type collection of *Eudarluca australis* (fig. 1 a and 1 c). Besides 2-septate spores, a few 1- or 3-septate spores have been observed.

In 1830 DUBY (p. 695) recorded *S. caricis* "In foliis *Caricis depauperatae* in sylvis prope Beauvais".

In 1849 FRIES (p. 387) listed *S. caricis* and three other species immediately after the genus *Dothidea* under the heading: "Incerte generis, priori affinis". Several authors have incorrectly interpreted this as a transfer of these species to *Dothidea*.

There is in fact one collection on *Carex* sp. in Herb. FRIES (UPS) labelled "*Dothidea caricis*, — Getinge, Halland". This collection contains however a different fungus from that on *Carex oederi*. Macroscopically it looks like a *Phyllachora* sp. Most loculi are empty, but in some of them conidia of the *Stagonospora* type are to be found. The leaves are not infested by rust.

In 1849 KICKX (p. 24) recorded *S. caricis* from Gand (=Gent, Belgium). See also 1867!

In 1851 BERKELEY & BROOME (p. 187) recorded *S. caricis* from Scotland, "on leaves of *Caricis*, West Water, Forfarshire".

In 1854 WESTENDORP (p. 28) listed *S. caricis* in his "Les cryptogames classés d'après leurs stations naturelles" on *Carex oederi* only.

In 1857 RABENHORST published an exsiccatum of "*Phoma filum* Ces. Forma *Caricis*" in "Herbarium mycologicum" (ed. II, ser. 1, no. 448). This fungus is stromatic *Eudarluca* (in S). No loculi could be found in the stromata. *Sphaeria caricis* Fr. is not given as a synonym and is probably not the basionym to the name proposed by RABENHORST (see also 1863).

In 1863 RABENHORST distributed *S. caricis* in his "Fungi europei exsiccati" as no. 535. The matrix is given on the label as *Carex muricata*. This is not correct. It is a grass, probably a member of *Triticeae*. The fungus is a *Phyllachora*, most likely *Ph. graminis* (Pers. ex Fr.) Nits.

In 1863 GROGNOT (p. 103) in his "Plantes Cryptogames-cellulaires du département de Saone-et-Loire" stated that *S. caricis* is uncommon on leaves of *Carex* in summer and autumn.

In 1866 in MORIÈRE's annotated list of the fungi collected by ROBERGE in the department of Calvados in northern France we find (p. 137): "*Sphaeria caricis*, var. *B. depauperata* (Desmaz.)! Sur les feuilles sèches d'un *Carex*, Été". The exclamation-mark means that a collection from Calvados had been distributed by DESMAZIÈRES in his "Plantes cryptogames du Nord de la France". According to OUDEMANS (1919, p. 1048) *Sphaeria caricis* var. *depauperata* is distributed in Ed. I as no. 2057 and in Ed. II as no. 1757. I have not had access to these numbers and do not know whether or not they are conspecific with *S. caricis*. I have however seen a sample (UPS) with this name, collected by ROBERGE at Caen in Calvados. The matrix is *Carex* sp., but it is difficult to say whether it is *Carex vulpina* as stated in DESMAZIÈRES exsiccata. Nevertheless it is very probable that the fungus distributed by DESMAZIÈRES was collected by ROBERGE and that part of his collection was sent to FRIES, perhaps for confirmation. The sample in UPS turned out to be mature *Eudarluca*. The spores are of the same type as in the original collection of *S. caricis*.

In 1867 KICKX (p. 403) transferred *S. caricis* to the genus *Sphaeropsis* Lév. among the "Athèques, Sphaeropsidées Lév.". He said, however: "Quelques spores nous ont paru avoir deux ou trois cloisons transversales, mais trop peu distinctement pour pouvoir l'affirmer. Si l'existence de ces cloisons était bien constatée, la plante devrait faire partie du genre *Hendersonia* et y être placée à côté de l'*H. graminicola* Lév.". The septa of 2-septate ascospores in *Eudarluca caricis* are often rather indistinct and according to the description of the habit of his fungus, KICKX may very well have studied the rust parasite, although he overlooked the asci.

In 1871 COOKE (p. 806) quoted BERKELEY & BROOME's record of *S. caricis* under the name "*Dothidea caricis* Fr.". In fact he seems himself to be the first one to publish it as a species of *Dothidea*.

In 1874 OUDEMANS (p. 316) recorded a collection of "*Dothidea Caricis* Fr." from Nijkerk (the Netherlands).

In 1883 BUCKNALL (p. 59) reported "*Dothidea caricis* Fr." from Blaise Castle Wood, Bristol district (England). Asci were "broadly oblong .0024 in." [=c. 60  $\mu$ ] and the ascospores "oblong, apparently becoming 3 or 4 septate, .001 in. long" [=c. 25  $\mu$ ]. BUCKNALL considered this collection immature, but he obviously discerned a faint septation

in the ascospores. Thus he cannot have studied a *Phyllachora* species, possibly *Eudarluca caricis* with 2- (and/or 3-) septate ascospores. The habit of BUCKNALL's fungus is that of *Darluca filum* (op. cit., fig. 8).

In 1883 SACCARDO (p. 625) transferred *S. caricis* to *Phyllachora*. He annotated: "Ph. Graminis affinis". He had certainly not seen any material, as the description given by him is only a verbatim repetition of FRIES' diagnosis.

In 1884 SACCARDO (p. 164) made the new combination *Phoma caricis* (Fr.) Sacc. and considered *Sphaeropsis caricis* (Fr.) Kickx as synonymous. He did accordingly not discover that this species and *Phyllachora caricis* are both based on *Sphaeria caricis* Fr.

In 1885 COOKE (p. 63) described the asci and the ascospores of "*Dothidea caricis* Fr." as follows: "Asci clavatis. Sporidiis ellipticis, continuis, hyalinis". This description points to COOKE's having studied a *Phyllachora* species instead of a *Eudarluca*.

In 1886 BERLESE & VOGLINO (in SACCARDO, *Sylloge Fungorum*, *Additamenta* ad vol. I—IV, p. 314) assigned *Phoma caricis* to the genus *Macrophoma*. By writing "*Macrophoma Caricis* Berl. & Vogl. in *Atti Soc. Veneto-Trentina*, p. 195. — *Phoma Caricis* Sacc. *Syll. III*, p. 164." they indicated that this transfer already had been done. This cannot be correct. The "Atti" of 1886 were not published until 1887, but evidently they had seen a printer's proof of their treatise on *Macrophoma* already in 1886. All references in "Additamenta" to this treatise are five pages too low. This is obviously due to a later insertion of a paper by BERLESE, which is of five pages.

In 1886 MASSEE (p. 36) quoted the known locality Forfarshire and also reported "*Phyllachora caricis* (Fr.) Sacc." from a new British locality, viz. Swanscombe Marshes.

In 1887 WINTER (in RABENHORST, p. 899) reduced *S. caricis* to a variety of *Phyllachora graminis*, which species he commented on as follows: "Eine sehr gemeine Art, die aber sowohl im Habitus, als in der Grösse der Asci und Sporen auf den verschiedenen Nährpflanzen kleine Unterschiede zeigt . . . Nur die Form auf *Carex* zeigt etwas bedeutendere Unterschiede". The ascospores were described as "elliptisch, bei voller Reife bräunlich, 14—16  $\mu$  lang, 7  $\mu$  dick". This description matches the spores of the fungus distributed in RABENHORST, *F.eur.*, no. 535 (cf. above, 1863). This is the only collection cited by WINTER. In addition he gives the information "Auf lebenden *Carex*-Blättern".

In 1891 SACCARDO (p. 1026) quoted COOKE's complementary description of the ascospores of *Phyllachora caricis*.

In 1892 SACCARDO (p. 205) accepted the transfer of *Phoma caricis* (Fr.) Sacc. to *Macrophoma* (cf. 1884).

In 1892 ELLIS & EVERHART (p. 599) reported *Phyllachora caricis* from Albany (New York, U.S.A.) and like SACCARDO and WINTER, stated that it is allied to *Ph. graminis*.

In 1897 REHM (p. 373) described and figured (fig. XII: 10) a new variety of *Phyllachora caricis* from South America, viz. var. *brasiliensis* Rehm. The figure shows that REHM's fungus may be a *Phyllachora* but cannot be a *Eudarluca*.

In 1899 ALLESCHER (in RABENHORST, p. 360) accepted *Macrophoma caricis* as a good species. In all he dealt with eighty species of this genus.

In 1904 ROSTRUP (p. 13) reported *Ph. caricis* from Norway, on *Carex oederi*. This collection (0) proved to represent the stromatic from of *E. caricis*. Pycnidia, but no perfect state, were present. The vascular plant is the same as in FRIES' original collection of *S. caricis*.

In 1928 LIND (p. 63) recorded *Phyllachora caricis* on *Carex* sp. from Åreskutan (Jämtland, central Sweden). This collection is supposed to be in C or UPS, but I have searched for it in vain.

In 1934 LIND (p. 79) recorded *Phyllachora caricis* on "*Carex norvegica*" (= *Carex mackenziei* Krecz., non *Carex norvegica* Retz.) from Hudson Bay, Cape Eskimo, 61°05' (Canada) and on *Carex rostrata* from Abisko (northern Sweden). I have seen the Swedish collection (C). Only immature stromata could be found. They do not belong to *Eudarluca*, as they are black throughout, nor was any rust present on the leaves.

### *Dothidea genistalis* Pers. ex Fr.

In 1815 MOUGEOT & NESTLER issued fascicle V of their "Stirpes Cryptogamae Vogeso-Rhenanae" with "488. *Sphaeria genistalis* Pers. in Litt. — Ad folia exsiccata *Genistae sagittalis*".

In 1823 FRIES, in his *Systema mycologicum* (p. 552), transferred this species to the genus *Dothidea*, and gave it the following description:

"10. *D. genistalis*, erumpens, tuberculosa, difformis, atra, intus alba, cellulis periphericis albis.

*Sphaeria*. Pers.! (Moug.! & Nestl. exs. n. 448.).

Primo tecta, dein epidermide lacerata erumpens, sordide nigra, tubercula sistens minuta, subconfluentia, *Sphaeriae* cuidam immaturae similia. Stroma compactum albidum. Cellulae minutae, subfarctae. In foliis vivis & exsiccatis *Genistae sagittalis*. (v.s.)."



FRIES, like many authors after him, incorrectly quoted the number in MOUGEOT & NESTLER as 448 instead of 488. This original collection of *Dothidea genistalis* turns out to be a *Eudarluka*. Unfortunately it is immature, but the stromata (fig. 3 d and 5 c) match those in the original collection of *Sphaeria caricis* perfectly (fig. 2 b). The pseudothecial loculi were obviously observed already by FRIES.

There is one collection in UPS labelled by FRIES: "*Dothidea genistalis*. Fr. — In *Spartio Scopario*, — Scaniae". This is certainly collected at a later date as it was not taken into consideration in *Systema mycologicum*. Otherwise he would have noted "v.v." (=vidi vivam) instead of "v.s." (=vidi siccam) and added *Spartium scoparium* (= *Sarothamnus scoparius*) as a host. The fungus in this collection is not congeneric with *D. genistalis*. The stromata yielded muriform conidia. This is probably a member of the genus *Dichomera* Cooke.

Several mycologists paid attention to *Dothidea genistalis* during the immediately following years. As a rule, they gave no exact informations about localities and it is merely possible to state from which country the fungus was reported. *Dothidea genistalis* is listed:

in 1826 by CHEVALIER (p. 456) in his "Flore général des environs de Paris" (France),

in 1830 by DUBY (p. 713) in his "Botanicon Gallicum" (France),

in 1833 by SECRETAN (p. 693) in his "Mycographie Suisse" (Switzerland),

in 1833 by WALLROTH (p. 864) in his "Flora Cryptogamica Germaniae" (Germany).

In 1844 RABENHORST (p. 164) in his "Deutschlands Kryptogamen-Flora" wrote about *Dothidea genistalis*: "An lebenden und abgestorbenen Blättern und Stengeln der *Genistae sagittalis*, hier und da, nicht selten (bei Kreuznach 1841 im herbst, Rabenh.)."

In 1849 FRIES (p. 386) reported the above mentioned misdetermined collection of *Dothidea genistalis* on *Sarothamnus* from Scania (= Skåne, southern Sweden).

In 1855 KICKX (p. 17; also 1867, p. 298) recorded *Dothidea genistalis* from the Botanical Garden in Gand (=Gent, Belgium).

In 1863 GROGNOT (p. 123) in his "Plantes Cryptogames-cellulaires du département de Saone-et-Loire" gave *Dothidea genistalis* as rather common.

In 1865 FÜCKEL (p. 330) stated "dass die *Dothidea genistalis* Fr. gar keine *Dothidea* ist, sondern das *Phoma Filum* Fr. (*Darluka Filum* Berkl.), auf *Uromyces smarotzend.*" and l.c.):

„Die eigenthümliche der Entwicklung des *Phoma Fil.* auf *Cytisus sag.* besteht darin, dass sich die Perithechien desselben auf dem Mutterboden des *Uromyces* bilden, noch ehe die Sporen des letzteren die Oberhaut durchbrochen. Die Folge davon ist, dass sich nur wenige Sporen des *Uromyces* bilden und der Mutterboden desselben gleichsam monströs anschwillt. Sobald die Oberhaut zerreist, kommen die Perithechien des *Phoma* Vorschein, der früher grünliche Mutterboden des *Uromyces* wird schwarz und schwillt immer mehr an, so, dass die anfangs freien Perithechien halb eingesenkt erscheinen. In diesem Stadium hat der Pilz, oberflächlich betrachtet, einige Aehnlichkeit mit einer *Dothidea*. Ich habe nur die charakteristischen Sporen von *Phoma Filum* finden können, niemals Schläuche. An den Exemplaren in Moug. und Nestlr. fand ich die Sporen des *Phoma* nicht, weil an den dünnen Stengeln die Perithechien desselben schon entleert waren, wohl aber fand ich in allen untersuchten Häufchen derselben die leeren Perithechien des *Phoma Filum* und die Sporen des *Uromyces*. Es sind daher diese Specimina als veraltetes *Phoma Filum* Fr. zu betrachten. Hiernach ist die bisherige *Dothidea genistalis* Fr. als nicht existirend zu streichen.“

FUCKEL is the first author to point out that *Dothidea genistalis* is uredinicolous (on "*Uromyces*"=*Uromyces laburni* (DC.) Fuck., the only rust species on *Genista sagittalis* L. according to GÄUMANN 1959, p. 369), and that it is conspecific with *Darluca filum*.

In 1867 CROUAN & CROUAN (p. 35) listed "*Dothidea genistalis* Fr." in their "Florule Du Finistère". They had probably not seen FUCKEL's paper. They are the first and only authors who have described the ascospores in this species: "Epores à sporidioles uniseriées. Oblongues". It is possible that they had collected the form of *Eudarluca caricis* with 2-septate ascospores. I have not been able to examine their material, as loans from their herbarium are not admitted (by their will).

In 1870 FUCKEL (p. 378—379) recognized four varieties of *Darluca filum*, viz. var. *vulgaris* (575, 1030), var. *dothideaeformis* (1014), var. *stromatica* (2132) and var. *hypocreoides* (2131). The figures in brackets give the numbers in FUCKEL's "Fungi rhenani", where these varieties had been distributed. Var. *dothideaeformis* (syn. *Dothidea genistalis* Fr. according to FUCKEL) should not be uncommon on *Cytisus sagittalis* (= *Genista sagittalis*) in spring. The reason why FUCKEL never found mature perithecia is that this fungus was collected too early in the year.

Var. *stromatica* "wuchert ebenfalls im Anfang in Uredoräschen, später aber bildet sich ein weit verbreitetes, oft die ganzen Halme, unter der Oberhaut schwarzfärbendes Stroma. In wie weit dieses mit *Dothidea graminis* im Zusammenhang steht, lasse ich dahin gestellt sein, sowie auch den genetischen Zusammenhang von *Darluca* und *Dothidea* überhaupt, bin aber sehr geneigt, erstere für die Pycnidien der letz-

teren zu halten". The original collection of this variety (*Fungi rhenani*, no. 2132) from near Hallgarten in Austria is on *Agrostis stolonifera*. Examination of an isotype (UPS) revealed that the stromata contain immature loculi of a pyrenomycete and collapsed uredospores. This is certainly immature *E. caricis*. It has nothing to do with *Phyllachora graminis* (= "*Dothidea graminis*") as pointed out already by HÖHNEL (1927, p. 55).

In 1879 ROUMEGUÈRE distributed *Dothidea genistalis* from "Reliquae Mougetianae" in his "Fungi gallici exsiccati" (no. 94).

In 1880 the same species appeared in ROUMEGUÈRE's exsiccatum (no. 888) as "*Phacidium Cytisi* Rab.réuni au *Dothidea genistalis*". ROUMEGUÈRE probably got the name from JACK, LEINER & STIZENBERGER's exsiccatum "Kryptogamen Badens", no. 642, "*Phacidium Cytisi* Rab., Monogr. Peziz. ined.". RABENHORST never published the diagnosis. This fungus (UPS) is not conspecific with *Dothidea genistalis*, but possibly is with "*Phacidium Cytisi* Fuckel" (1871, p. 328). ROUMEGUÈRE's collection is, however, *Dothidea genistalis* and no "*Phacidium*" could be found mixed with it.

In 1880 SACCARDO (p. 108), contrary to FÜCKEL, considered *Darluca filum* and *Dothidea genistalis* separate species and made the new combination *Darluca genistalis* (Fr.) Sacc. It should differ from *Darluca filum* by "peritheciis dense aggregatis, robustioribus etc.". FÜCKEL's variety *dothideaeformis* of *Darluca filum* became merely a synonym of *Darluca genistalis*, and (in 1884, p. 410) the other varieties distinguished by FÜCKEL, except the main variety *vulgaris*, were also transferred to the latter species.

In 1899 ALLESCHER (in RABENHORST, p. 702—704) adopted SACCARDO's classification of *Darluca*.

In 1913 GROVE (p. 45) reported and described a collection of *Darluca genistalis* from Dublin (Ireland) on *Uromyces anthyllidis*. A more detailed description was given by GROVE in 1935 (p. 340). According to him *D. genistalis* is distinguished from *D. filum* almost solely by its densely clustered habit. GROVE's collection seems to correspond to FÜCKEL's var. *hypocreoides* of *D. filum*.

There are rather few later publications on *Darluca genistalis*, but it is distributed in KABÁT & BUBÁK's "Fungi imperfecti exsiccati" as no. 462 from Böhmen (Bohemia) (the prominent stromata in this collection (S) do not contain any perithecial loculi) and reported from Thessaloniki (Greece) by KONSTANTINIA-SULIDU (1939, p. 291) and from India by CHONA & MUNJAL (1950).

***Dothidella appendiculata* deLacr. ex Br. & Har.**

In 1859 DELACROIX (p. 404) published the nomen nudum *Dothidea appendiculata*. This name refers to a collection on *Chondrilla juncea* from St.-Romain-sur-Vienne. Part of this was distributed by SCHULTZ in his "Herbarium normale" (Fasc. 8, no. 799).

In 1891 BRIARD & HARIOT (p. 170) gave this species a diagnosis in the genus *Dothidella*. It runs as follows:

"D. stromate rotundato, atro, epidermide tecto, saepius confluenti, plano vel prominulo, 1 mm. diam.; ostiolis granuliformibus, superficie rugulosa; ascis cylindraneo-clavatis, breviter stipitatis, 50—70=8—10  $\mu$  pro parte sporarum; paraphysibus filiformibus; sporis 8-nis, distichis, ovato-oblongis, utrinque attenuatis, 1-septatis, ad septum constrictulis, loculis 2-guttulatis vel non, dilute-olivaceis, subhyalinis, 12—14=4—5  $\mu$ , utrinque appendiculo brevi, hyalino praeditis.

Ad caules *Chondrillae junceae*, Saint-Romain-sur-Vienne (Vienne) cl.ab. de Lacroix."

In 1891 ROUMEGUÈRE issued an exsiccatum of *Dothidella appendiculata* (Fungi sel. exs., no. 5760). This collection is a part of "Reliquae Lacroixianae" and was communicated to ROUMEGUÈRE by HARIOT. Hence it can be regarded as type material.

In 1915 THEISSEN & SYDOW (p. 625) transferred *Dothidella appendiculata* to the genus *Diplochorella*. They considered it a doubtful species, as they could not find any perithecial loculi.

In 1941 PETRAK (p. 320) studied material of "*Dothidea appendiculata* deLacroix" from SCHULTZ's exsiccatum. He stated that this species had been misinterpreted by earlier mycologists:

"Auf den dünnen *Chondrilla*-Stengeln finden sich ganz verdorbene Teleutolager von *Puccinia chondrillina* Bub. et Syd. Auf und in diesen Lagern, von denen meist nur noch Spuren vorhanden sind, parasitiert eine durch kräftiger entwickeltes Stroma ausgezeichnete Form von *Darluca filum* (Biv.) Cast. mit länglich spindelförmigen, ca. 12—16=3—4  $\mu$  grossen, beidseitig mit kurzen, schleimigen Anhängseln versehenen, mehr oder weniger stark verschrumpten und miteinander verklebten Konidien. Weil die Konidien in mehr oder weniger radiären Reihen nebeneinander liegen, kleben sie oft zu mehreren neben- und hintereinander zusammen. Derartige schmale, oft ziemlich langgestreckte Konidienklumpen können bei oberflächlicher Betrachtung in Quetschpräparaten leicht für Schläuche gehalten werden. So sind die irrigen Angaben von Hariot und Briard zu erklären. *D. appendiculata* mit allen darauf begründeten Synonymen ist daher nur eine schlecht entwickelte Form von *Darluca filum* (Biv.) Cast. und als ein Synonym davon zu betrachten."

It is remarkable that PETRAK did not fancy the possibility that BRIARD & HARIOT had seen and described the perfect state of *Darluca filum*. This state is generally stromatic and the thorough description of the asci given by BRIARD & HARIOT points to their having seen real asci and not merely "miteinander verklebten Konidien". This does not preclude the possibility of their having described conidia instead of ascospores. I have studied material of this species from both exsiccata mentioned above. Asci and ascospores were met with in both cases. In ROUMEGUÈRE's material (UPS) the ascospores were in a very bad condition, but two septa could be discerned in some ascospores. In SCHULTZ's material (S) this septation was easy to see, although the spores did not readily leave the asci. Appendages could of course only be found in conidia, and BRIARD & HARIOT certainly mistook these for ascospores.

(*Sphaerella pucciniophila* Sacc. & Syd. in Sacc.)

In 1890 in ROUMEGUÈRE's "Fungi selecti exsiccati" (no. 5237; schedae also in Rev. Mycol. 1890, p. 61—69) FAUTREY described a new pyrenomycete under the name *Sphaerella parasitica* as follows:

"Les groupes de *Puccinia*, nés sous la feuille forment, à la page supérieure une tache blanchâtre; sur cette tache, sont enfoncés, en grand nombre, les périthèces de *Phyllosticta* [should be *Phyllosticta*] *destructiva*, puis, plus rares et plus gros, ceux de la nouvelle espèce de *Sphaerella*. Thèques cylindracées, 45, 60×15 de 4, 6 ou 8 spores distiques, inéquilatérales, uniséptées, hyalines à plusieurs gouttes, 20, 25×5, 7. Pas de paraphyses.

Sur *Puccinia Malvacearum* des feuilles sub-vivantes d'*Alcea rosea*. Noidan (Côte-d'Or).".

In 1899 SACCARDO & SYDOW (in Sacc., p. 533) replaced the epithet "parasitica" by "pucciniophila", as *Sphaerella parasitica* Fautr. was anticipated by an earlier homonym, *Sphaerella parasitica* Winter (1886, p. 19).

I have studied a part of the original collection in ROUMEGUÈRE's exsiccatum. Only the *Phyllosticta*, mentioned in the diagnosis, could be found in the leaf-spots. It is difficult to know whether or not the pyrenomycete has something to do with *Eudarluca*. Perhaps it is *Mycosphaerella* sp., as the asci are comparatively broad and there should be no paraphyses.

**(*Didymella darluciphila* Speg.)**

In 1909 SPEGAZZINI (p. 357) described *Didymella darluciphila*, an uredinicolous pyrenomycete from Argentina. The ascocarps were "amphigena hinc inde aggregata, 0.5—2 mm. long., 250—500  $\mu$ . lat." and the ascospores "fusoides clavulatis, subcurvulis, 12—18=3 medio 1-septatis, hyalinis, biguttulatis v. non.". It was mixed with "*Darlucula australis*" on leaves of *Andropogon condensata* infested with *Puccinia andropogonicola*.

In 1946 HANSFORD (p. 58) guessed that *D. darluciphila* could be a synonym of *E. australis*. He did never study any type material. Nor have I, but SPEGAZZINI's description and figure (op. cit., fig. 13) suggest *E. caricis*.

**(*Didymella kariana* Sacc.)**

In 1914 SACCARDO (p. 301) described this fungus from India. The following is quoted from the diagnosis:

"Peritheciis epiphyllis, laxe gregariis, ... sporidiis distichis, fusoides, utrinque obtusiuscule attenuatis, curvulis, 16—18 $\times$ 4.5, medio septatis, leviter constrictis, typice 4-guttatis, hyalinis.

*Hab. in foliis morientibus Polygoni* sp. latifoliae, socia Uredine *Puccinia Polygoni* (?) et *Darlucula filo*, ...".

In 1946 HANSFORD (p. 58) proposed the possibility that *D. kariana* could be a synonym of *Eudarlucula australis*, but he had not access to any type material and could not verify this surmise. It is possible that HANSFORD is right. I have seen one collection of *Eudarlucula* (IMI, no. 62099 e) with unilocular ascocarps and 1-septate ascospores. However, most ascocarps were plurilocular and the unilocular ones were not "laxe gregaria".

***Leptosphaeria nigrificans* Bub. & Wróbl. in Bub.**

In 1916 BUBÁK & WRÓBLEWSKI (in BUBÁK 1916 a, p. 329) described a new pyrenomycete, *Leptosphaeria nigrificans*, as follows:

"Peritheciis singulis vel gregariis, immersis, epidermide tectis, globosis, vel parum applanatis, 150—200  $\mu$  in diam. apice subconico erumpentibus, atris, in pseudostromate sub epidermide atrobrunneo, intus flavobrunneo immersis.

Ascis cylindricis vel cylindraco-clavatis, 55—65  $\mu$  longis, 9—10  $\mu$  latis, rectis vel curvatis, supra rotundatis et incrassatis, basi attenuatis, breve pedicellatis, octosporis, paraphysibus filiformibus, crebris obvallatis.

4 *Botaniska Notiser* 1966.

Sporidiis distichis, rarius tristichis, fusoideis, 13—19  $\mu$  longis, 3.5—4  $\mu$  latis, rectis vel curvatis, utrinque attenuatis, dilutissime olivaceis, biseptatis.

Galicja: Werbiaż Niżny in foliis et culmis *Caricis* sp. (*C. leporinae*?), IX. 1912. leg. A. Wróblewski.”.

The authors pointed out that this species is almost stromatic on account of “Schwärzung der oberen Mesophyllschichten und das Zusammenfliessen der Fleckchen”. Mixed with this species they found uredosori of *Puccinia silvatica* Schröt. and *Darluca filum* (Biv.-Bern. ex Fr.) Cast. Already from this diagnosis and the appended notes it is reasonable to guess that *L. nigrificans* is identical with *E. caricis*. An isotype in S turned out to be a good material of this rust parasite (fig. 1 b and 4 d).

Except SACCARDO (1928, p. 982), where the diagnosis of *L. nigrificans* also is quoted, there is no later literature on this species. It is worth mentioning that SACCARDO (op. cit., p. 1415) indexed *L. nigrificans* as “*nigricans*” by mistake. This epithet refers to another species of *Leptosphaeria* (op. cit., p. 981).

### ***Myrmaecium cannae* Dearn. & Barth. in Dearn.**

In 1917 DEARNESS & BARTHOLOMEW (in DEARNESS, p. 347) described a new pyrenomycete, “(?) *Myrmaecium cannae*”, from Puerto Rico. From the diagnosis the following may be extracted:

“Stromata minute, . . . Perithecia black, one to several in a stroma, . . . Sporidia hyaline, 1-septate, upper cell larger, 10—15 $\times$ 4—8  $\mu$ . Some of the perithecia filled with conidia and sporophores; conidia linear-oblong, obscurely 1-septate, 15 $\times$ 2.5—3  $\mu$ .

On withered leaves of *Canna indica* L., . . . Type collection, Fungi Columb. 5038.”.

There is no diagnosis of this fungus in BARTHOLOMEW's exsiccatum “Fungi Columbiani”.

In 1927 PETRAK (p. 301—302) stated that *M. cannae* is a synonym of *Eudarluca australis* Speg. PETRAK's opinions on *M. cannae* and *E. australis* are dealt with on p. 54.

### ***Uleodothis paspali* Stev.**

In 1924 STEVENS (p. 181, fig. III: 20—23) described a new stromatic pyrenomycete, *Uleodothis paspali*. From his diagnosis of this fungus the following may be quoted:

"Stromata occupying the whole region between the upper and lower epidermis, . . . Perithecia 1 to 30 in a group on a single stroma, . . . Spores 14 to 18  $\times$  3.5  $\mu$ , fusiform, 1-septate, hyaline, guttulate.

On *Paspalum conjugatum*.

British Guiana: Coverden, August 8, 1922, 759."

In 1929 PETRAK (p. 333) regarded *U. paspali* as a synonym of *E. australis*. I have not seen any type material of STEVENS' fungus, but everything in the diagnoses and the figure subjoined to it speaks in favour of PETRAK's opinion.

### *Eudarluka indica* Ramakr.

In 1951 RAMAKRISHNAN (p. 158) described a new urediniculous pyrenomyce, *Eudarluka indica*, from India. He stated that it comes close to *E. australis*. In fact, there are certainly no reasons for keeping them separate (see p. 58). *E. indica* (UPS, isotype) is typical *E. caricis* (= *E. australis*), with stromatic ascocarps and 1-septate ascospores.

## Taxonomy

DANSER (1950, p. 118) has written: "Many false conceptions have arisen in systematics because living beings were treated as objects which the scientist proposed to classify. Once for all attention must be drawn to the fact that the systematist never classifies objects but life-cycles.". Most mycologists consider this opinion more or less self-evident. Classification within, e.g., the pyrenomycetes often requires a thorough knowledge of the imperfect states of the species to be classified. An illustration to this is the genus *Pyrenophora* Fr., in which several species are kept separate solely by their having different imperfect states. Concerning the genus *Eudarluka*, we may not preclude the possibility of several urediniculous species. A cursory examination of the perfect state suggests that there are at least two such species, but in my opinion there is most likely only one species. This, however, must be demonstrated experimentally, taking the imperfect states into consideration.

As mentioned above (p. 35), besides the macroconidial state *Darluka*, there may be a microconidial state in *E. caricis*. I have seen micropynidia mixed with macropynidia in several collections (e.g., IMI, no. 79400 b). The texture of the wall is the same in both types of pynidia. The habit is also the same. The microconidia are very small, only c. 2–3  $\times$  1  $\mu$ , non-septate and hyaline. The macroconidia show a wider



range of variation and are consequently of greater interest in the taxonomy than the microconidia. In general the individual collections of *Darluca* are comparatively homogeneous. No wonder there has been described a number of species in this genus, based on rather subtle morphological differences. This state of affairs has attracted the interest of several mycologists, e.g., DIEDICKE (1912, p. 150), HÖHNEL (1927, p. 27), SYDOW (1926, p. 417) and PETRAK (1929, p. 371). SYDOW and PETRAK considered *Darluca* a monotypical genus. HÖHNEL pondered this possibility, but he maintained, e.g., *Darluca genistalis* as a separate species. Thus, a fungus described by BUBÁK (1916 b, p. 151) as *Diplo-dothiorella Sadurneri* was placed as a synonym of *Darluca genistalis* by HÖHNEL (op. cit., p. 53). *D. genistalis* should differ from *D. filum* in being stromatic. They may, however, be modifications of one and the same species. The shape and the extension of the stromata depends largely on the morphology of the host of the rust. In one very aberrant collection of *Darluca* on *Sphaerophragmium artabotrydis* Doidge, Uganda (IMI, no. 79018), the pycnidia are clustered in moriform aggregates. Another collection (IMI, no. 5078), also from Uganda and on the same host, contains the perfect state. It has the same habit. The ascospores are 1-septate and do not differ from those in other collections of *Eudarluca* from Africa. This moriform habit is also represented in a collection from South Africa, described as *Botryella nitidula* Syd. & Syd. (1916, p. 95), but already shown by HÖHNEL (1918, p. 140) to be a *Darluca*. Examination of the type specimen (S) revealed that this is correct. The wall of the pycnidia is not as thick as in the African collection. The conidia have in both these cases the appendages, which are so typical of *Darluca*.

MÜLLER & ARX (1962, p. 314) transferred three pyrenomycetes to *Eudarluca*. These colonize fungi but not rusts. Only one of them, *E. connata* (Syd.) Arx, is apparently known to have an imperfect state. In this state, *Metabotryon connatum* Syd., the conidia, according to these authors, are coloured, non-septate and lacking appendages. It is doubtful whether this fungus is congeneric with *Darluca-Eudarluca*.

On the whole, the imperfect states do not yet give us any clue as to how many species there are in *Eudarluca*. First we have to study them comprehensively, morphologically as well as experimentally. The following considerations are entirely based on studies of the morphology of the perfect state.

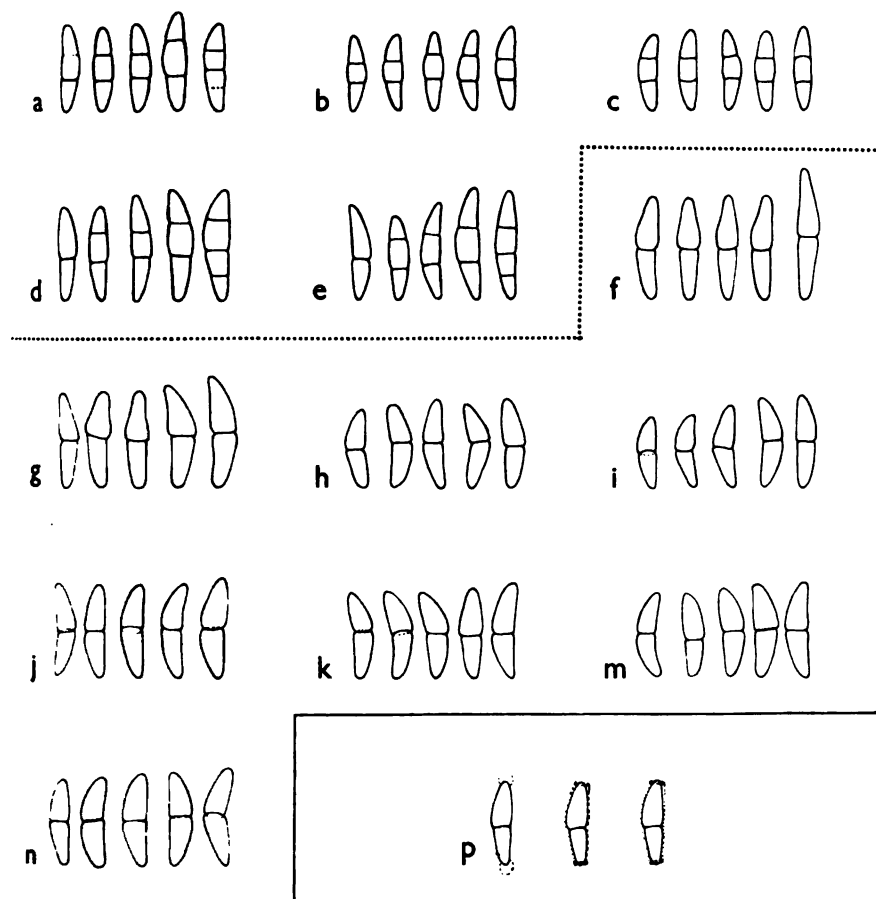


Fig. 1 *Eudarlucacaricis*. a—e. Ascospores with (1—) 2 (—3) septa. f—n. Ascospores with 1 septum. p. Ascospores with gelatinous equipments in different stages. — References to "Collections Examined" (p. 62): a (36=*Sphaeria caricis* Fr., coll. orig.), b 40=*Leptosphaeria nigrificans* Bub. & Wróbl., Isotypus), c (12=*Eudarlucacaricis* Speg., Isotypus), d (39), e (37), f (38), g (21), h (24), i (7), j (4), k (17), m (18), n (2), p (—). — Magnification: all figures  $\times 780$ .

### Morphology of the Ascospores

Features in ascospores are in general considered to be of the utmost moment in the taxonomy of *Ascomycetes*, especially on the species level, but sometimes also on the generic or taxonomically still higher levels. In *E. caricis* we are mostly interested in the septation of the ascospores, but their shape, colour and gelatinous equipments also merit attention.

**Septation.** As mentioned above, SYDOW (1926, p. 360) claimed that two collections from Costa Rica were conspecific with *Eudarluca australis* Speg., although the ascospores were 1-septate and not 2-septate as described by SPEGAZZINI. Concerning the septation of the ascospores SYDOW was however somewhat vague: "wohl mit drei Querwänden, von welcher aber fast immer nur die mittlere deutlich erkennbar ist" and some lines below on the same page:

"Vergleicht man die vorstehende Beschreibung mit der Spegazzinischen Diagnose, so fällt, abgesehen von kleineren Differenzen, besonders auf, dass die Schlauchsporen nach Spegazzini 3-zellig sein sollen, wie sie auch von ihm abgebildet werden, während an dem vorliegenden Materiale 3-zellige Sporen nicht beobachtet worden. Trotzdem glaube ich, dass mein Pilz mit der *Eudarluca australis* identisch ist, indem ich annehme, dass dem Autor bei der Beobachtung ein Fehler unterlaufen ist. Ein Teil der Originalkollektion der *Eudarluca australis* stand zum Vergleich zur Verfügung, doch erwies sich dasselbe leider völlig unbrauchbar, da es nur leere Gehäuse enthielt."

SYDOW's emendation of *Eudarluca* is compiled on p. 37. The ascospores were described as "2-zellig in völlig reifem Zustande vielleicht 4-zellig". In a later paper SYDOW (1929, p. 426) reported that he had found that the ascospores in a mature collection of *E. australis* were 3-septate.

SYDOW was never contradicted in this question, but supported by several other authors. As mentioned on p. 37, PETRAK (1927, p. 301) examined SYDOW's two collections from Costa Rica, an isotype of *Eudarluca australis* and one of *Myrmaecium cannae*. He was sure that these four collections belonged to one and the same species, *Eudarluca australis* Speg. The isotype of this species was "aber schon ganz alt, zeigt an der von mir gesehenen Exemplar keine Spur einer Fruchtschicht". Like the type material of *E. australis* the isotype of *M. cannae* was also collected on *Canna indica*. It was mature, and the ascospores were "zweizellig, bisweilen aber auch durch eine, in der oberen Hälfte entstehende Querwand dreizellig". The ascospores in the collections from Costa Rica were 1-septate, but in the largest spores PETRAK could discern two additional septa. He summarized his studies thus (p. 301) :

"Die Sporen dieser Art scheinen in Form und Grösse sehr veränderlich zu sein. In ähnlicher Weise scheinen ja auch die Konidien der Nebenfruchtform zu variieren, was zur Aufstellung verschiedener *Darluca*-Arten geführt hat, welche zweifellos alle mit einander identisch sind." and (p. 302) "Diese grosse Veränderlichkeit der Sporen dürfte vor allen darauf zurückzuführen sein, dass der Pilz auf allen mir vorliegenden Kollektionen gewiss noch nicht ganz reif ist, zum Teile auch deutliche Spuren von Entwicklungshemmungen zeigt."

I have studied one of SYDOW's collections from Costa Rica, an isotype of *Eudarluca australis* and two isotypes of *Myrmaecium cannae*. The isotype of *E. australis* (from Herb. SYDOW, now in S) is certainly the very collection examined by SYDOW and subsequently also by PETRAK. Most of it is actually over-ripe, but in one small area of a leaf fragment mature pseudothecia were found. They contained ascospores coinciding very well with those figured by SPEGAZZINI. The other three collections yielded only 1-septate ascospores. The habit of all the specimens on *Canna indica* is largely the same, but in one case the ascospores are 1-septate (*Myrmaecium cannae*) and in the other they are 2-septate (*Eudarluca australis*).

In addition I examined 27 other collections with the perfect state in a mature condition. Of these 21 had 1-septate ascospores and 6 had 2-septate spores. In some cases 1-septate immature ascospores could be found together with 2-septate mature spores. The septum in these immature spores is very often not median as commonly is the case in "normally" 1-septate ascospores. Such a difference would in general be looked upon as a very fundamental one. For several reasons I feel we must not do so here:

1. Although the individual collections generally show either 1- or 2-septate ascospores, there is no sharp borderline between the two types of spores as to the location of the septa. It is in fact possible to find some "normally" 1-septate ascospores mixed with 2-septate spores (see fig. 1 d) although most 1-septate spores are  $\pm$  apiosporous. Sometimes 3-septate spores are found in pseudothecia with 2-septate spores. In such spores the medium septum takes the same position as the single septum in the "normally" 1-septate spores.
2. As mentioned above 1- and 2-septate ascospores, respectively, occur in two otherwise similar collections on the same matrix (*Puccinia cannae* on *Canna indica*).
3. The type of septation described here is not unique. Other fungi with ascospores that are normally 1-septate, but occasionally have an additional septum, are, e.g., *Mollisia nigrescens* (Feltg.) LeGal & Mang. and *M. hydrophila* (Karst.) Sacc. (LEGAL & MANGENOT 1961, figs. 8 and 23 B) and *Massarina aquatica* Webster (1965, fig. 1 A-B). The cells in these 2-septate spores are of equal length.

**Shape.** The shape of the ascospores varies somewhat in 1- as well as in 2-septate spores. In some collections the 1-septate spores are distinctly

swollen especially on one side of the septum. This feature is never seen in 2-septate spores, but as it is not prominent in all collections with 1-septate spores, it is most probably of no taxonomical value.

**Colour.** 1-septate ascospores are always hyaline, while 2- and 3-septate spores are pale honey-yellow. If they all belong to one species we may assume that the 1-septate spores are immature and that on maturing they turn coloured and get an additional septum (or septa). If they are immature this would be a case of neoteny, as 1-septate ascospores may germinate without further septation. This is shown in a figure that HANSFORD added to one of his collections in Herb. IMI (no. 13605). Another explanation is that the hyaline and 1-septate spores are mature, while the 2- or 3-septate, coloured spores are the results of a development under some extreme conditions, e.g. a spell of dry weather. I think this last interpretation is the most reasonable one, because in several collections with 2-septate spores the spores are in a comparatively bad condition and do not readily leave the asci. Also the ascocarps are for the most rather poorly developed in these collections (see below).

**Gelatinous equipments.** In almost all collections the ends of the ascospores are provided with mucous cushions (fig. 2 d). These seem to have been overlooked by earlier authors. This is probably due to the fact that they commonly dissolve very quickly in water, at least in their margins and thereby turn almost invisible. They are however very easy to see if, for instance, Congo red or Melzer's reagent is added immediately after the ascocarps have been placed in water and squashed under the coverslide. If for a later re-examination glycerine or lactophenol, respectively, is added to the mounts it will be very difficult to discern any cushions. In many collections each ascospore is enclosed in a mucous covering, which seems to be decapitated at the ends of the spores. In fact they are not. There is a mucous cupola at each end of the spore, but these cupolas dissolve very rapidly in water. I am sure there is no fundamental difference between these types of gelatinous equipments. They represent different stages of development instead (fig. 1 p). All these stages have been found in 1-septate spores, which can be regarded as normally developed in this respect also. In 2-septate spores only the first described type of gelatinous equipment have been met with. In this case the wall of the spore and the cushions are not so readily dissolvable as they are in mature 1-septate ascospores. This may be due to some unfavourable conditions under the development.

The biological significance of the cushions is clear when HANSFORD's figure in the above mentioned collection from Herb. IMI is studied. In all he sketched 15 ascospores, which all germinated apically but never laterally. The same is true for three conidia figured by HANSFORD in the same collection. As is well-known, the conidia in this species are provided with apical appendages.

### Morphology of the Ascocarps

At the beginning of my studies on *Eudarluca* it appeared to me as if the septation of ascospores and the morphology of ascocarps were correlated in this species. One-septate spores were generally found in "loculi" enclosed in very prominent stromata. The ascocarps which yielded 2-septate spores did not show such a stromatal aspect. In at least two collections the fungus even seemed to belong to the genus *Phaeosphaeria* Miyake (see fig. 4 c).

This trend has persisted, but I have now seen collections in which the characters are not combined in the way described above. Thus in the original collection of *Sphaeria caricis* the ascocarps are stromatic and the spores 2-septate. These stromata match those which yield 1-septate spores in all details. One collection (IMI, no. 62099 e) shows stromata with 1-septate ascospores but also clusters of solitary pseudothecia, with exactly the same type of ascospores. From this it is reasonable to conclude that differences in the morphology of the ascocarps are of minor taxonomic significance.

STEVENS (1924, p. 181) observed a remarkable character in the stromata of his *Uleodothis paspali* (= *E. australis* fide PETRAK): "While the locules sometimes have a lining consisting of one or two rows of cells darker than the remainder of the stroma such a lining is not always present and I regard the fungus in the summation of its characters as Dothideaceous rather than Sphaeriaceous." Linings of this type ("stromata in stromata"??) can be seen in fig. 5 b. In fig. 5 c and 2 b they are not so distinct, but in fig. 5 a no compact stromatic tissue between the "linings" is to be found. In this case we have densely clustered pseudothecia with a common clypeus.

### "Paraphyses" (=Pseudoparaphyses)

According to HANSFORD (1946, p. 58) *Eudarluca australis* Speg. should be devoid of paraphyses. Such were figured by SPEGAZZINI and described by e.g. SYDOW (1926, p. 361). When RAMAKRISHNAN (1951, p.

158) described his new species *Eudarluca indica*, he pointed out that the most important feature in this species was the presence of "paraphyses". He had obviously not examined any type material of *E. australis* as he referred to HANSFORD when stating that this species had no "paraphyses". I have found pseudoparaphyses in all collections of *Eudarluca* I have studied, and they certainly do not provide any useful criterion in this genus. *Eudarluca indica* is merely a synonym of *E. caricis*.

## Distribution and Ecology

Data on all collection of *E. caricis* (also all reliable records in the literature) can be derived from Table 1 and under the heading "Collections Examined". (p. 62).

The collections with 1-septate ascospores have been called *Eudarluca australis* Speg. Most of them were published earlier. This form of the species has been found in all parts of the world. The single European collection is unpublished. The fungus was collected by me in an immature state in Dalecarlia (=Dalarna, Sweden) in June of 1962. The same locality was visited again in March, August and December of 1964. In March the fungus was immature, in August it was mature and yielded 1-septate spores and finally in December the perithecia were empty and new immature ascocarps were developing in the uredosori of this year's leaves. The host of the rust, *Puccinia caricina* DC., is *Carex diandra*. The tussocks in this locality are unusually tall. Several generations of leaves bend down and constitute a tunnel around the base of the tussock. This hollow is very humid and offers thereby an especially favourable milieu to *E. caricis*. It has been pointed out e.g. by RAMAKRISHNAN & NARASIMHALU (1941) and SEBESTA (1963) that *Darluca-Eudarluca* probably prefers high humidity. The more common occurrence in the Tropics also may indicate this.

The collections with 2-septate ascospores have been given several different names. One find is from Brazil, all the others from Europe. Except for one of the Swedish collections they were all published earlier. Two collections merit some further comments:

1. "*Leptosphaeria folliculata* Ell. & Ev." was collected by MÜLLER (1950, p. 269) in Switzerland. I have examined this material and found that it is well developed *E. caricis* (fig. 1 d). At a first glance no traces of a rust can be seen on the vascular plant (a grass). If, however, the

leaves are scrutinized under high magnification, some small empty cavities, typical for those caused by a rust, can be seen.

*Leptosphaeria folliculata* was described on material found by DEARNESS on *Carex* sp. in Canada. I have examined the holotype (NY) and an isotype (DAOM). According to the original description (ELLIS & EVERHART 1890, p. 237) the perithecia are situated on pale leaf spots. There were plenty of such spots in both samples, but of a perfect state only one single pseudothecium of *Mycosphaerella* sp. could be found. The spots seem to be caused by *Phyllosticta* (pycnidia c. 40—50  $\mu$ , conidia 3 $\times$ 1  $\mu$ ). No 2-septate ascospores have been met with and *L. folliculata* remains a mystery.

2. A find of *Eudarluka* with 2-septate spores (fig. 1 e) was made by me in Västerbotten (northern Sweden) in June of 1962. The locality was a hollow in a compost heap, c. 10 meters from a rivulet. In this hollow the microclimate may certainly have been  $\pm$  "tropical". *Eudarluka* grew on some old fragments of *Elytrigia repens*. In the summer of 1965 it was searched for in vain.

*Darluka filum* has been collected on a large number of rust genera, while the perfect state generally is found on *Puccinia* spp. on members of *Gramineae* and *Cyperaceae*. This is probably due to the fact that these plants often grow in and themselves make up a milieu, which is favourable for *Eudarluka*. Moreover, their tissues are in most cases comparatively resistant to decomposition. About two thirds of the collections studied by me are on species belonging to one of these families. The rust is commonly attacked in its uredinial stage, but in, e.g., the original collection of *Sphaeria caricis*, both uredo- and teleutosori are to be found.

It was stressed by HULEA (1939, p. 196) that *Darluka filum* and a number of other fungi found in connection with rusts should not be considered parasites but commensals. There is no doubt that *E. caricis* at least in its perfect state is parasitic. In general it is stromatic and in the stromata uredospores are enclosed and totally demolished. The problem is whether these compact stromata nourish exclusively on killed uredospores. We may not eliminate the possibility that *Eudarluka* to some extent may also feed directly upon the vascular plant, as a parasite or a saprophyte. This is conceivable especially in some cases where the fungus looks like species of the genus *Phaeosphaeria* Miyake, e.g., the collection from Västerbotten. In this collection the fungus is very similar to, e.g., *Phaeosphaeria rousseliana* (Desm.) Holm. The matrix of the latter, *Phleum phleoides* (L.) Karst., is blackened from a



widely extended but thin clypeus. In the mentioned collection of *Eudarlucu* the pseudothecia are not seated in the uredosori, but just opposite them on the other side of the leaf (figs. 4 c and 5 a), and this side is blackened from the fungus. In this connection some physiological studies on *Darlucu filum*, performed by NICOLÁS & VILLANUEVA (1965, p. 782) are of interest. According to these authors. *D. filum* can utilize a large number of carbon compounds and probably does not need more than one nitrogenous compound. All amino acids required can then be synthesized by the fungus itself. These results suggest the possibility that *Darlucu-Eudarlucu* may also feed upon the vascular plants to some extent. It has never been found unless a rust has been present also. A wound on a vascular plant is certainly not enough for a successful attack by *Eudarlucu*, but there must be some other factor, e.g., a specific substance from the rust, that is required for the development of this pyrenomycete.

**Table 1. Distribution of the perfect state of *E. carleia*.**

Country	Publ. coll.: author and year Unpubl. coll.: collector	Name of the fungus (note 1)	Number of coll. (note 2)	Septation of spores (note 3)	Reference to Coll. Exam. (note 4)
<b>Africa</b>					
Ghana	Hughes	1952 E.a.	1	1	1
Guinea	Kranz	1963 E.a.	2	?	—
—	Kranz	— E.a.	1	1	2
Kenya	Nattrass	1961 E.a.	3	1	3
Libya	Kranz	1964 E.a.	1	?	—
Malawi	Bisby & Wiehe	1953 E.a.	×	?	—
Nigeria	Harris	— E.a.	1	1	4
Sierra Leone	Deighton	— E.a.	3	1	5. 6. 7
South Africa	Doidge	1941 E.a.	3	1—3	—
Sudan	Tarr	1963 E.a.	×	c	×
Tanzania	Wallace & Wallace	1949 E.a.	2	?	—
—	Pirozynski	— E.a.	1	1	8
Togo	Hughes	1952 E.a.	1	1	9
—	Hughes	— D.f.	1	i	10
Uganda	Hansford	1946 E.a.	×	1	11
<b>America</b>					
Argentina	Spegazzini	1909 *Di.d.	2	1	—
Brazil	Spegazzini	1908 *E.a.	1	2	12
British Guiana	Petrak	1929 E.a.	—	—	—
—	=Stevens	1924 *U.p.	1	1	—
Costa Rica	Sydow	1926 E.a.	2	1	13
Dominic Republic	Petrak & Ciferri	1932 E.a.	2	1	14.15
—	Petrak	? E.a.	1	i	16

Table 1. Continued.

Country	Publ. coll.: author and year Unpubl. coll.: collector	Name of the fungus (note 1)	Number of coll. (note 2)	Septation of spores (note 3)	Reference to Coll. Exam. (note 4)
Ecuador	Sydow	1939 E.a.	1	?	—
—	Petrak	1949 E.a.	1	?	—
Jamaica	Hansford	— E.a.	1	1	17
—	Leather	1962 E.a.	1	1	18
Puerto Rico	Petrak	1927 E.a.			
	=Dearn. & Barth.	1917 *M.c.a.	1	1	19
U.S.A.	Keener	1951 E.a.	4	1	—
—	Petrak	1953 E.a.	2	?	—
Venezuela	Sydow	1930 E.a.	2	1	20.21
<b>Asia</b>					
China	Sydow	1929 E.a.	1	3	—
India	Saccardo	1914 *Di.k.	1	1	—
—	Ramakrishnan	1951 *E.i.	1	1	22
Japan	Katamoto	1964 E.a.	1	1	—
North Borneo	Petrak	1954 E.a.	1	i	23
—	Forster	— E.a.	1	1	24
—	Johnston	1960 E.a.	2	?	—
—	Johnston	— E.a.	1	1	25
Sarawak	Johnston	— E.a.	1	1	26
<b>Australia</b>					
New Caledonia	I.F.O.	— E.a.	1	1	27
New Guinea	Johnston	1961 E.a.	1	1	28
<b>Europe</b>					
Belgium	Kickx	1855 Do.g.	1	?	—
Austria	Fuckel	1864 Do.g.	1	i	29
—	Fuckel	1868 *D.f.s.	1	i	30
Finland	Karsten	— D.f.	1	i	31
France	Moug. & Nestl.	1815 S.g.	1	i	32
	=Fries	1823 *Do.g.			
—	Chevalier	1833 Do.g.	×	?	—
—	Grognot	1863 Do.g.	×	?	—
—	Morière	1866 S.c.d.	1	2	33
—	Crouan & Crouan	1867 Do.g.	×	?	—
—	Roumeguère	1880 Do.g.	1	i	34
—	Briard & Hariot	1891 *Dot.a.	1	2	35
Germany	Wallroth	1833 Do.g.	×	?	—
—	Rabenhorst	1844 Do.g.	×	?	—
Sweden	Fries	1823 *S.c.	1	2	36
—	Eriksson	— —	1	1	37
—	Eriksson	— —	1	2	38
Switzerland	Secretan	1833 Do.g.	×	?	—
—	Müller	1950 L.fo.	1	2	39
U.S.S.R.	Bubák & Wróblewski	1916 *L.n.	1	2	40

Note 1. The names of the fungi are abbreviated as follows:

- D.f. = *Darluca filum*  
 D.f.s. = *Darluca filum* var. *stromatica*  
 Di.d. = *Didymella darluciphila*  
 Di.k. = *Didymella kariana*  
 Do.g. = *Dothidea genistalis*  
 Dot.a. = *Dothidella appendiculata*  
 E.a. = *Eudarluca australis*  
 E.i. = *Eudarluca indica*  
 L.fo. = *Leptosphaeria folliculata*  
 L.n. = *Leptosphaeria nigrificans*  
 M.ca. = *Myrmaecium cannae*  
 S.c. = *Sphaeria caricis*  
 S.c.d. = *Sphaeria caricis* var. *depauperata*  
 S.g. = *Sphaeria genistalis*  
 U.p. = *Uleodothis paspali*

\*=the original description of the fungus in this paper.

Note 2. ×=the number of collections of the perfect state not given by the author.

Note 3. c=recorded as the perfect state, but only the imperfect state found.

i=immature perfect state.

?=septation unknown.

Note 4. ×=collection examined, but the perfect state not refound.

## Collections Examined

The perfect state of *Eudarluca caricis* (Fr.) O. Eriks. was examined in the collections listed below. (If nothing else is stated, the collections were labelled *Eudarluca australis* Speg.).

### Africa.

1. Ghana, Aburi, 13. XI. 1924, C. B. (no. 140) (IMI, no. 13605).  
On *Puccinia rufipes* Diet. (on *Imperata arundinacea* Cyrillo).
2. Guinea, IRF Kindia, 10. XII. 1963, (IMI, no. 105011 c), J. KRANZ.  
On *Puccinia versicolor* Diet. & Holw. (on *Andropogon tectorum* Schumach.).
3. Kenya, Limuru, alt. 7000 ft, IV. 1950, R. M. NATTRASS (no. 1365) (IMI, no. 41125).  
On *Puccinia kampalensis* Cumm. (on *Wedelia* sp.).
4. Nigeria, Zaria Province, Shika, 10. IX. 1958, E. HARRIS (IMI, no. 75759).  
On *Uredo* sp. (on *Hyparrhenia rufa* (Nees) Stapf).
5. Sierra Leone, 19. XII. 1936, F. C. DEIGHTON (IMI, no. 43387 b).  
On *Uredo famelica* Arth. & Cumm. (on *Mucuna* sp.).
6. Sierra Leone, Musaia, 13. XII. 1946, F. C. DEIGHTON (IMI, no. 11340).  
On *Puccinia* sp. (on *Hyparrhenia rufa* (Nees) Stapf).
7. Sierra Leone, 1. XI. 1956, F. C. DEIGHTON (IMI, no. 68201 b).  
On *Puccinia polysora* Underw. (on *Zea mays* L.).
8. Tanzania, Kigoma, Kahombe, 4. I. 1964, K. PIROZYNSKI (Mi 87 a) (IMI, no. 106009 a).  
On *Uromyces leptodermus* Syd. (on *Panicum maxicum* Jacq.).

9. Togo, Hohoe, 28. V. 1949, S. J. HUGHES (IMI, no. 39688 a).  
On rust indet. (on *Andropogon* sp.).
10. Togo, Amedjofe Pass (on the top), 29. V. 1949, S. J. HUGHES (IMI, no. 39712).  
On rust. indet. (on *Ctenium* sp.).
11. Uganda, Kazi near Kampala, XI. 1940, C. G. HANSFORD (IMI, no. 5078).  
On *Sphaerophragmium artabotrydis* Doidge (on *Artabotrys nitida* Engl.).

#### America.

12. *Eudarluca australis* Speg. — TYPUS.  
Brasilia, São Paulo, Botanical Garden, 10. VIII. 1905, A. USTERI (ISOTYPUS: S).  
On *Puccinia cannae* (Wint.) Henn. (on *Canna indica* L.).
13. Costa Rica, La Caja near San José, 24. XII. 1924, H. SYDOW, [SYDOW, Fungi exot. exs., no. 636 (IMI, no. 13606; S; UPS)].  
On *Puccinia conoclinii* Seym. (on *Eupatorium sinclairii* Benth. ex Oerst.).
14. Dominican Republic, Salcedo, VIII. 1929, R. CIFERRI (no. 3011) (S).  
On rust indet. (on *Eleocharis geniculata* R. Br.).
15. Dominican Republic, Cordillera Central, Prov. de la Vega, at Rio Maimón, 17. XII. 1930, E. L. EKMAN (no. 3896) (S).  
On rust indet. (on *Cyperus picardae* Boeck).
16. Dominican Republic, Santo Domingo, Lano Costero, IX. 1926, R. CIFERRI [PETRAK, Myc. gen., no. 639 (IMI, no. 30539; S; UPS)].  
On rust indet. (on *Eleocharis* sp.).
17. Jamaica, Irinityville, 2. X. 1925, C. G. HANSFORD (no. 795) (IMI, no. 76473).  
On rust indet. (on *Rottboellia exaltata* L.f.).
18. Jamaica, Mandeville, 23. VII. 1962, R. L. LEATHER (IMI, no. 95526).  
On *Puccinia stenotaphri* (Syd.) Cumm. (on *Stenotaphrum secundatum* (Walt.) Kuntze).
19. *Myrmaecium cannae* Dearn. & Barth. — TYPUS.  
Puerto Rico, Cabo Rojo, 30. X. 1912, F. L. STEVENS, [BARTHOLOMEW, Fungi Columb., no. 5038 (ISOTYPUS: IMI, no. 13608; ISOTYPUS: S)].  
On *Puccinia cannae* (Wint.) Henn. (on *Canna indica* L.).
20. Venezuela, Caguita near Puerto La Cruz, 29. XII. 1927, H. SYDOW [SYDOW, Fungi exot. exs., no. 807 (IMI, no. 13607; S; UPS)].  
On *Schroeteria crotonis* (Burr.) Diet. (on *Croton currani* Blake).
21. Venezuela, Caguita near Puerto La Cruz, 27. XII. 1927, H. SYDOW (S).  
On rust indet. (on *Chaetochloa sulcata* (Aubl.) Hitchc.).

#### Asia.

22. *Eudarluca indica* Ramakr. — TYPUS.  
India, Anamalais, 22. IX. 1950, T. S. RAMAKRISHNAN. (ISOTYPUS: UPS).  
On *Uredo amomi* Petch (on *Amomum* sp.).
23. North Borneo, Tuaran ("Tauran"), 24. VII. 1931, J. & M. CLEMENS (IMI, no. 94660).  
On *Uredo* sp. (on a Cyperacea).
24. North Borneo, Keningau, IV. 1955, R. H. FORSTER (IMI, no. 62099 e).  
On *Puccinia polysora* Underw. (on *Zea mays* L.).

25. North Borneo, Keningau, 15. IX. 1959, A. JOHNSTON (IMI, no. 79341 b).  
On *Puccinia polysora* Underw. (on *Zea mays* L.).
26. Sarawak, Miri, 21. IX. 1959, A. JOHNSTON (IMI, no. 79400 b).  
On *Puccinia nakanishikii* Diet. (on *Cymbopogon citratus* (DC.) Stapf).

#### Australia.

27. New Caledonia, Nouméa, 21. IX. 1964, I. F. O. (IMI, no. 113453).  
On *Uromyces* sp. (on *Heteropogon contortus* (L.) Beauv. ex Roem. & Schult.).
28. New Guinea, Biak, Kambong Landbouw, 12. VI. 1959, A. JOHNSTON (IMI, no. 77479).  
On *Puccinia rufipes* Diet. (on *Imperata cylindrica* (L.) Beauv.).

#### Europe.

29. *Dothidea genistalis* Pers. ex Fr. (= *Darluka filum* (Biv.-Bern. ex Fr.) Cast. var. *dothideaeformis* Fuck. — COLL. ORIG.).  
Austria, L. FÜCKEL [FÜCKEL, Fungi rhenani, no. 1014 (S)].  
On *Uromyces laburni* (DC.) Fuck. (on *Genista sagittalis* L.).
30. *Darluka filum* (Biv.-Bern. ex Fr.) Cast. var. *stromatica* Fuck. — COLL. ORIG.  
Austria, L. FÜCKEL [FÜCKEL, Fungi rhenani, no. 2132 (S; UPS)].  
On *Puccinia* sp. (on *Agrostis stolonifera* L.).
31. *Darluka filum* (Biv.-Bern. ex Fr.) Cast.  
Finland, Turku (Åbo), 6. IV. 1861, P. A. KARSTEN (HEL).  
On *Puccinia* sp. (on *Anthriscus silvestris* (L.) Hoffm.).
32. *Dothidea genistalis* Pers. ex Fr. — COLL. ORIG.  
France [MOUG. & NESTL., no. 488, "*Sphaeria genistalis* Pers. in litt." (UPS) [ROUMEGUÈRE, Fungi gall. exs., no. 94, (UPS)].  
On *Uromyces laburnei* (DC.) Fuck. (on *Genista sagittalis* L.).
33. *Dothidea genistalis* Pers. ex Fr.  
France, Aude, Narbonne, IX. 1879 [ROUMEGUÈRE, Fungi gall. exs., no. 888 (UPS)].  
On *Uromyces laburnei* (DC.) Fuck. (on *Genista sagittalis* L.).
34. *Darluka filum* (Biv.-Bern. ex Fr.) Cast. var. *depauperata* Desm.  
France, Caen, ROBERGE (UPS).  
On *Puccinia* sp. (on *Carex* sp.).
35. *Dothidella appendiculata* deLacr. ex Br. & Har. — COLL. ORIG.  
France, Vienne, St.-Romain-sur-Vienne, IV. 1855, DELACROIX [SCHULTZ, Herb. norm., fasc. 8, no. 799, "*Dothidea*" app., (S)] [ROUMEGUÈRE, Fungi gall. exs., no. 5760 (S; UPS)].  
On *Puccinia chondrillina* Bub. & Syd. (on *Chondrilla juncea* L.).
36. *Sphaeria caricis* Fr. — COLL. ORIG.  
Sweden (UPS).  
On *Puccinia* sp. (on *Carex oederi* Retz.).
37. Sweden, Västerbotten, Bygdeå, 21. VI. 1962, O. Eriksson (no. 1386 b) (UPS).  
On *Puccinia* sp. (on *Elytrigia repens* L.).
38. Sweden, Dalarna, Säter, Nordalen, 5. VI. 1962, 29. III. 1964, 27. VIII. 1964, 8. XII. 1964, O. ERIKSSON (nos. 1214 a, 2457 a (mature), 2537 a) (UPS).  
On *Puccinia caricina* DC. (on *Carex diandra* Schrank.).
39. *Leptosphaeria folliculata* Ell. & Ev.  
Switzerland, Kt. Graubünden, Bergün, Val-Plaz-bi, 30. VII. 1949, E. MÜLLER (UPS, ZT).  
On rust indet. (on *Calamagrostis villosa* (Vill.) Gmelin.).

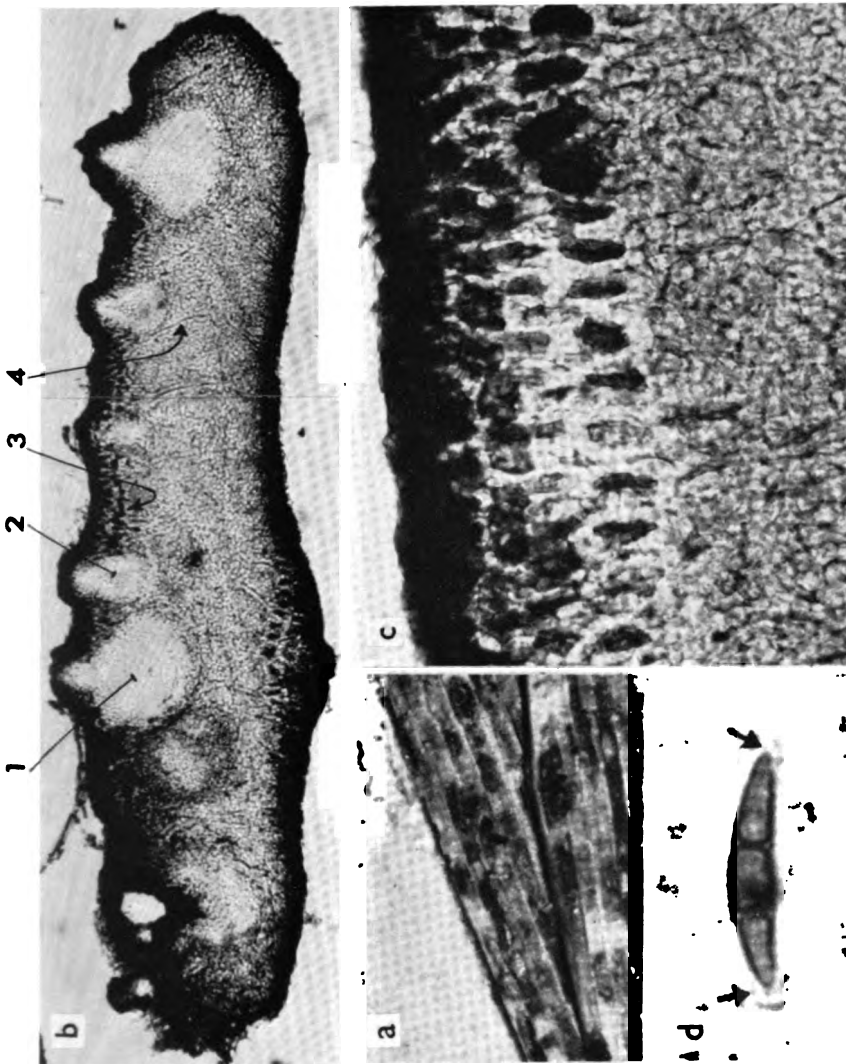


Fig. 2. a—d. *Eudarluca caricis*. a. Stromata and rust sori on leaves of *Carex oederi*. b. Pseudothecial locus (1), pycnidium (2), destroyed uredospores (3) and leaf tissue (4) enclosed in a stroma (longit. sect.). This stroma immature, others on the same leaf with 2-septate ascospores. c. Uredospores in a stroma. d. Ascospore with mucous cushions at the ends. — References to "Collections Examined" (p. 62): a—c 36=*Sphaeria caricis* Fr., coll. orig.), d (37). — Magnifications: a  $\times 12$  b  $\times 110$ , c  $\times 460$ , d  $\times 1550$ .

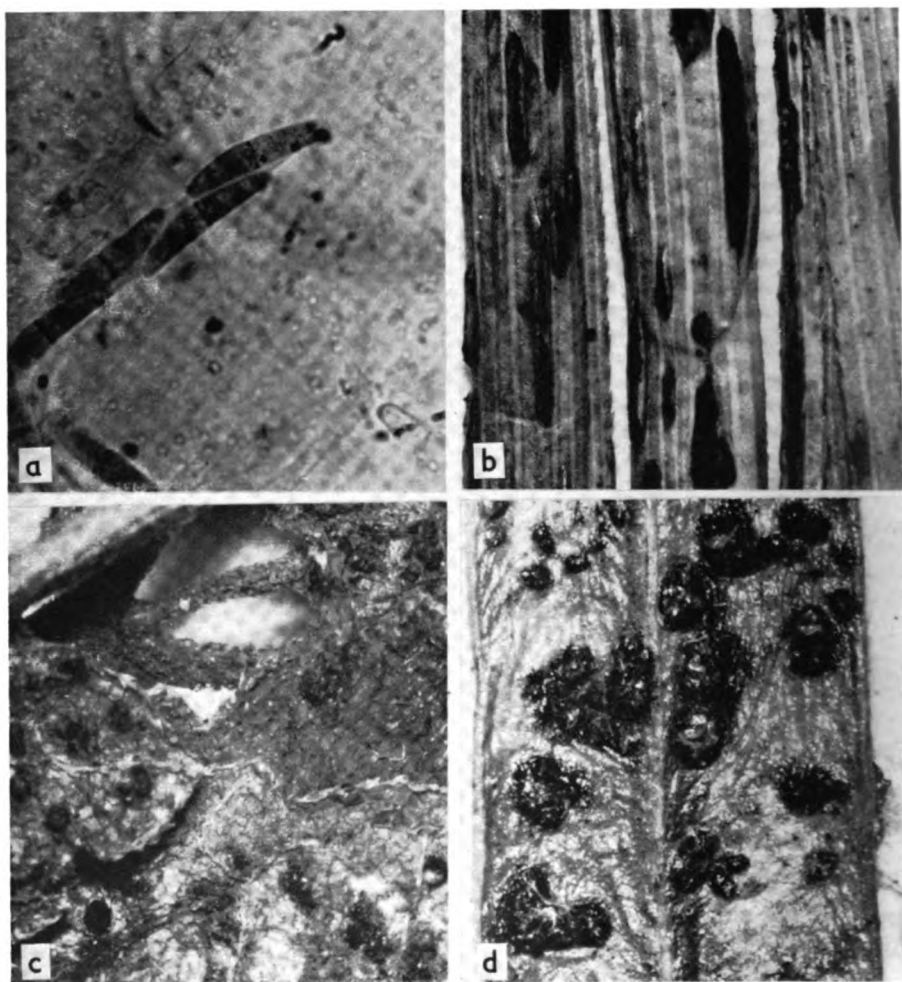


Fig. 3. a—d. *Eudarluca caricis*. a. One-septate ascospores and pseudoparaphyses. b. Ascocarps (yielding 1-septate spores) in leaves of *Carex diandra*. c. Ditto (ditto) in leaves of *Eupatorium sinclairii*. d. Ditto (immature) in "leaves" of *Genista sagittalis*. — References to "Collections Examined" (p. 62): a (38), b (38), c (13), d (32 = *Dothidea genistalis* Pers. ex. Fr., coll. orig.). — Magnifications: a  $\times 1000$ , b—d  $\times 11.5$ .

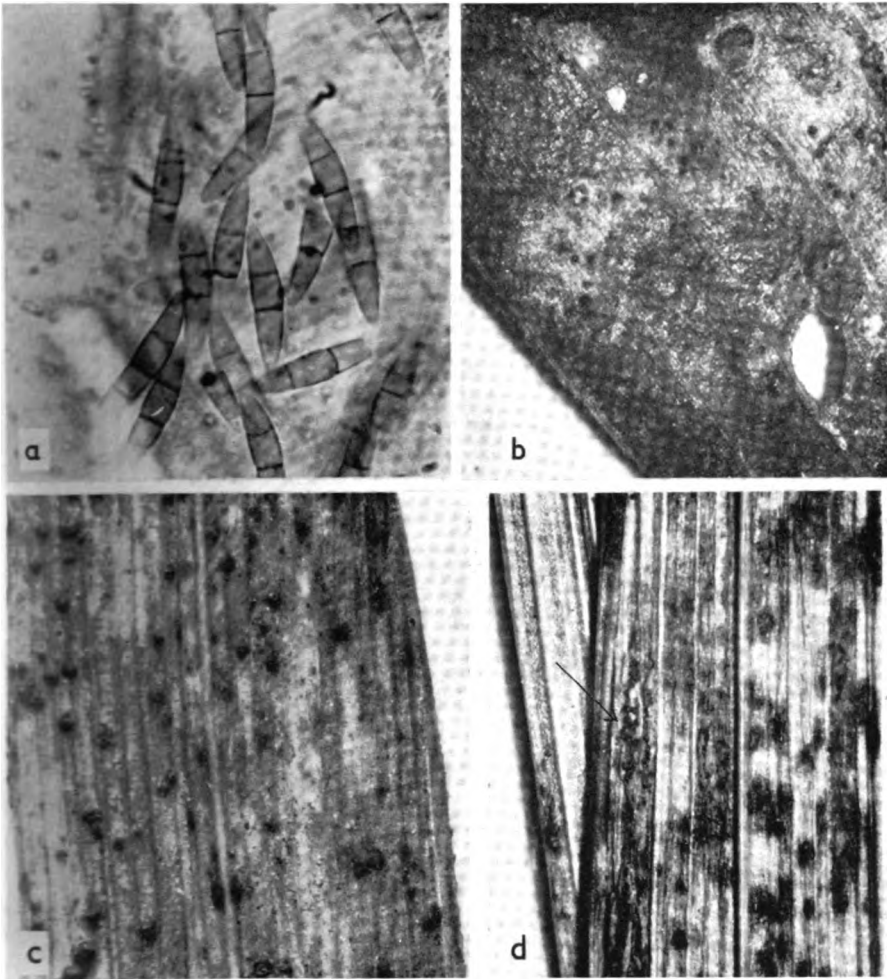


Fig. 4. a—d. *Eudarluca caricis*. a. Two-septate (and one 3-septate) ascospores. b. Ascocarps (yielding 2-septate spores) in leaves of *Canna indica*. c. Ditto (ditto) in leaves of *Elytrogia repens*. d. Ditto (ditto) and pycnidia of *Darluca filum* (arrow) in leaves of *Carex* (cf. *leporina*). — References to "Collections Examined" (p. 62): a (39), b (12=*Eudarluca australis* Speg., Isotypus), c (37), d (40=*Leptosphaeria nigricans* Bub. & Wróbl., Isotypus). — Magnifications: a $\times$ 1000, b—d $\times$ 11.5. — Cf. fig. 2 a—c.



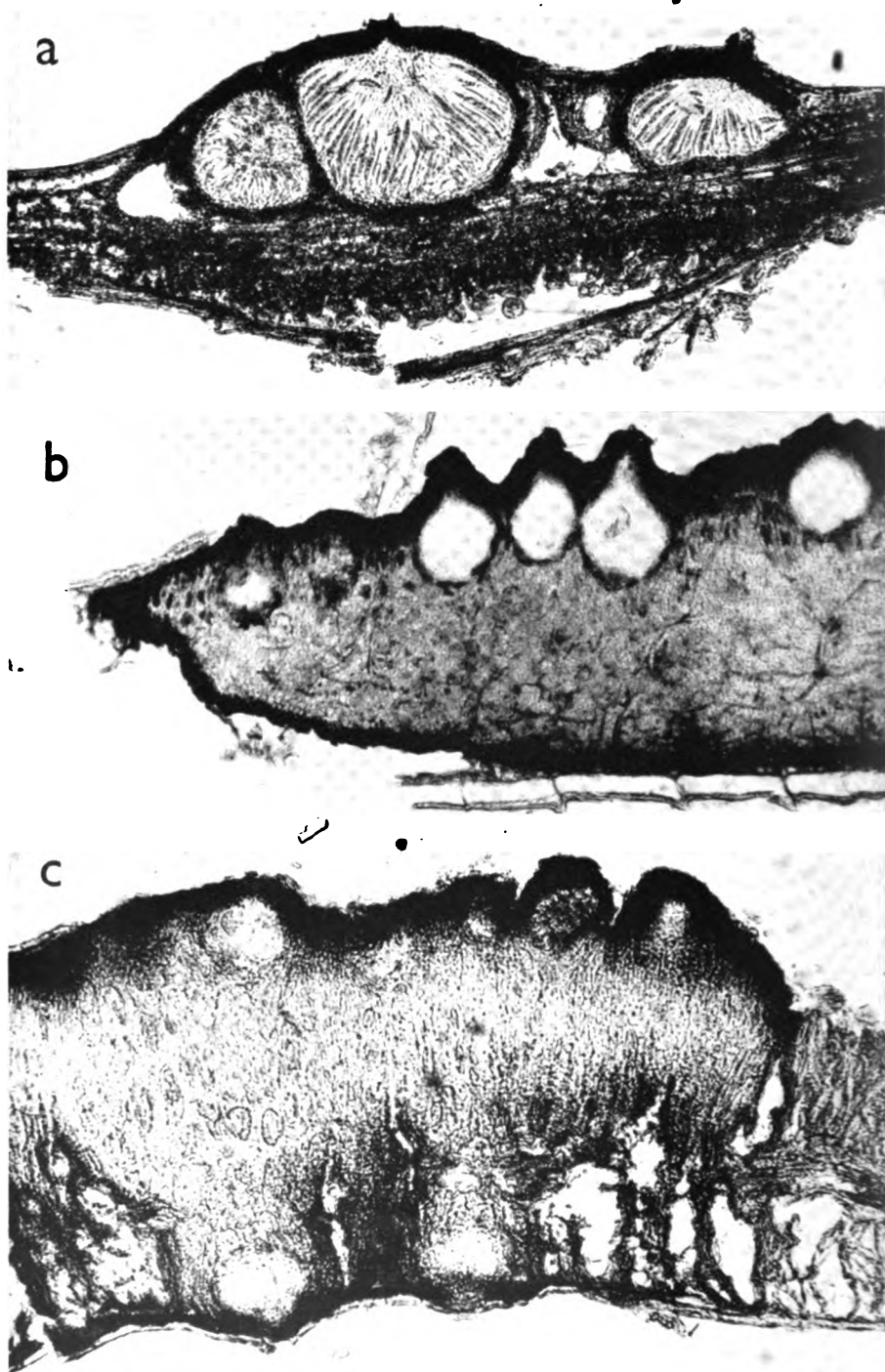


Fig. 5. a—c. *Eudarluca caricis*, Ascocarps with  $\pm$  well-developed stromatic tissue, a. Ascocarp yielding 2-septate spores (cf. fig. 2 c). b. Immature ascocarp (5. VI. 1962. 1-septate spores found 27. VIII. 1964; cf. fig. 3 b). c. Immature ascocarp (cf. fig. 2 d). References to "Collections Examined" (a. 69) (b. 37) (c. 99) (d. 32) — *Dactylis*

40. *Leptosphaeria nigrificans* Bub. & Wróbl. — TYPUS.

U.S.S.R., Ukraina, Werbiaż Niżny near Kolomea, IX. 1912, A. WRÓBLEWSKI  
(ISOTYPUS: S).

On *Puccinia* sp. (on *Carex* cf. *leporina* L.).

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### Summary

The perfect state of *Darluca filum* (Biv.-Bern. ex Fr.) Cast. is *Eudarluca caricis* (Fr.) O. Eriks. comb. nov. (Basionym: *Sphaeria caricis* Fr.). Synonyms of *E. caricis* are *Dothidea genistalis* Pers. ex Fr., *Dothidella appendiculata* deLacr. ex Br. & Har., *Eudarluca australis* Speg., *Eudarluca indica* Ramakr., *Leptosphaeria nigrificans* Bub. & Wróbl. in Bub., *Myrmaecium cannae* Dearn. & Barth. in Dearn. and *Uleodothis paspali* Stev. Original collections of two varieties of *Darluca filum*, viz. var. *dothideaeformis* Fuck. and var. *stromatica* Fuck., contain immature ascocarps of the perfect state. Possible synonyms of *E. caricis* are *Didymella kariana* Sacc. and *Didymella darluciphila* Speg.

The author has studied about 300 collections of *Darluca-Eudarluca*, 40 of which contained the perfect state of *E. caricis*. Of these collections 11 are from Africa, 10 from America, 5 from Asia, 2 from Australia and 12 from Europe. The perfect state was previously unknown from Europe. The author has found it twice in Sweden in the field, and also discovered it in herbarium material, collected in Austria, Finland, France, Sweden, Switzerland and U.S.S.R.

Nine of the 40 collections are immature. Of the mature collections 24 yielded 1-septate ascospores, while 2- (and sometimes also 1- and 3-) septate spores were found in 7 collections. No taxonomically fundamental differences have been found to exist between 1- and 2-septate spores in this material. Normally the ascospores of *E. caricis* are 1-septate, in the original collection they are 2-septate. The ascospores are provided with a mucous sheath and/or a mucous cupola at each end of the spore.

The ascocarps are commonly plurilocular stromata but unilocular ascocarps have been met with. The loculi often have a lining of one or two rows of cells darker than the remainder of the stroma, which in some collections is very loose or lacking.

*E. caricis* is generally found on *Puccinia* spp. on members of *Gramineae* and *Cyperaceae*. This is probably due to the fact that these plants grow in and themselves make up a milieu which is favourable for *Eudarluca*.

*E. caricis* is a parasite, but the possibility that it to some extent may feed upon the vascular plant may not be eliminated.

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## **Revision of Some Lichen Genera in Southern Africa I**

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### **Introduction**

In 1953 the present author had an opportunity to undertake a botanical journey in South Africa and some adjacent territories. My main purpose was to study the lichen flora, but I also brought home collections of vascular plants and of bryophytes, fungi and algae. I am preparing a Lichen Flora of Southern Africa, i.e., the Republic of South Africa, S.W. Africa, Bechuanaland, Basutoland, Swaziland, Rhodesia and Portuguese East Africa. This task will obviously take several years. As a preliminary, I am completing revisions of certain genera, out of systematic order, beginning with the foliose and fruticose lichens.

My lichen collections from 1953 amount to some 12 000 numbers. In addition to this material, I have been able to include a considerable number of lichens, mainly undetermined and collected by other botanists, especially from the herbaria at Cape Town, Pretoria and the British Museum in London. Very valuable collections from S. Africa were also placed at my disposal by Professor O. A. HÖEG, Oslo (from 1929—1930), Dr. R. A. MAAS GEESTERANUS, Leiden (from 1949), Dr. S. ARNELL, Uppsala (from 1951) and Dr. LUCIE KOFLER, Grenoble (from 1962—1964). The total number of specimens available for this study is about 30 000.

I have visited most herbaria, where specimens of lichens from S. Africa (especially types) are preserved, and I have had a major part of this material on loan. A survey of the herbaria that contain lichen collections of importance from S. Africa is given below.

**Collections of Lichens from South Africa**

- Berlin.** Botanisches Museum (B). Most old lichen collections lost. Some material (e.g., leg. H. WILMS) refound. Recent collections from S. Africa (leg. R. KRÄUSEL: cf. MATTICK 1956 p. 490) and S.W. Africa (leg. E. JENSEN).
- Budapest.** Museum of Natural History, Dept. of Botany (BP). Some collections by HÖEG (det. GYELNIK, SZATALA and VERSEGHY). Cf. VERSEGHY 1963 p. 579.
- Cambridge, Mass. U.S.A.** Farlow Herbarium (FH). Collections by C. S. WRIGHT et al. (det. TUCKERMAN).
- Cape Town.** Bolus Herbarium (BOL). Collections by A. V. DUTHIE, E. ESTERHUYSEN, S. GARSIDE, F. M. LEIGHTON, R. MARLOTH, N. S. PILLANS, E. A. SCHELPE et al.
- Kirstenbosch Botanical Gardens, including the Herbarium of the South African Museum (SAM). Several old collections, e.g., herb. PAPPE.
- Genève.** Conservatoire Botanique (G). Collections by, e.g., J. F. DRÈGE, H. WILMS, H. SCHINZ (det. J. MÜLLER ARG.), and H. A. JUNOD (det. J. STEINER).
- Glasgow.** Department of Natural History, Glasgow Art Gallery and Museums (GLAM). Herb. J. STIRTON. (Cf. under London).
- Helsinki.** Botanical Museum of the University (H). Herb. E. ACHARIUS and W. NYLANDER.
- Kew.** Botanical Gardens (K). Collections by, i.a., J. F. DRÈGE, C. F. ECKLON, K. ZEYHER, A. EATON, P. MACOWAN, C. S. WRIGHT, F. WILMS, and L. J. BRASS.
- Leiden.** Rijksherbarium (L). Collections by R. A. MAAS GEESTERANUS.
- Lisbon.** Institute of Botany, Fac. of Science (LISU). Collections from Angola (F. WELWITSCH et al.) and Portuguese East Africa.
- London.** Dept. of Botany, British Museum (BM). Collections by ECKLON, ZEYHER, DRÈGE, WELWITSCH (det. VAINIO), EATON (det. NYLANDER, ed. CROMBIE), MACOWAN (det. STIRTON), P. A. v. D. BYL (det. A. L. SMITH), GARSIDE, PILLANS, SCHELPE et al. Herb. STIRTON (in part).
- Linnean Society (LINN). Herb. LINNAEUS and LINNAEUS fil. Some collections by THUNBERG.
- Lund.** Botaniska museet (LD). Collections by ALMBORN and KOFLER.
- München.** Botanische Staatssammlung (M). Collections by BREUTEL, H. JELINEK, GUEINZIUS, WAWRA et al. Herb. KREMPELHUBER.
- Pietermaritzburg.** Dept. of Botany, University of Natal (NU). Collections by COMINS, KILLICK, SCHELPE et al.
- Pretoria.** Div. of Botany, National Herbarium (PRE). Numerous collections, mostly undetermined.
- Salisbury.** Southern Rhodesia Government Herbarium (SRGH). Collections by F. EYLES, H. WILD et al.
- Stellenbosch.** Dept. of Botany including Herb. v.D. BYL (STE-VB).
- Stockholm.** Dept. of Botany, Riksmuseum (S). Collections by THUNBERG, BREUTEL, DRÈGE, ECKLON, ZEYHER, J. A. WAHLBERG, J. F. VICTORIN et al.
- Trondheim.** Dept. of Botany, Museum (TRH). Collections by HÖEG.
- Turku (Åbo).** Dept. of Botany, University (TUR). Collections by WELWITSCH, v. D. BYL et al. (det. VAINIO).



- Uppsala. Dept. of Systematic Botany (UPS). Herb. THUNBERG (main collection, det. ACHARIUS). Some later collections by, i.a., WAHLBERG, VICTORIN, G. DE WYLDER, F. LJUNGQVIST and R. E. FRIES.
- Institute of Plant Ecology (Växtbiologiska Institutionen) (UPSV). Collections by J. ÖRTENDAHL and S. ARNELL.
- Verona. Museo Civico di Storia Naturale (VER). Collections by BREUTEL, ECKLON, ZEYHER and WAWRA (det. A. MASSALONGO).
- Wien. Naturhistorisches Museum (W). Collections by, i.a., WAWRA (det. MASSALONGO), JELINEK, FINCKE, MARLOTH, GUEINZIUS, F. & R. WETTSTEIN, J. B. LESLIE, J. BRUNNTHALER and v. D. BYL (all det. ZAHLBRÜCKNER).
- Botanisches Institut der Universität (WU). Collections by MENYHARTH (det. MÜLLER ARG.).
- Zürich. Institut für spezielle Botanik der Eidgen. Technischen Hochschule (ZT). Collections by ECKLON, BREUTEL, A. MACLEA, MACOWAN, A. REHMANN, WILMS et al. (all det. STIZENBERGER).

A detailed list of botanists who have collected lichens in southern Africa will be published in a later paper.

### Lichen Specialists Consulted

Specialists in certain lichen groups have kindly undertaken revisions of some genera. It is evident, however, that several groups, for which there are currently no specialists, e.g., *Graphidineae*, *Lecideaceae*, and *Lecanoraceae*, will need much more research before any results can be published.

The groups and specialists in question are:

- Acarospora* (W. A. WEBER, Boulder, Colo., U.S.A.).
- Anaptychia* (S. KUROKAWA, Tokyo, Japan).
- *Buellia* (H. A. IMSHAUG, East Lansing, Mich., U.S.A.).
- Caliciaceae* (A. SCHMIDT, Hamburg, Germany).
- \**Cladonia* (H. DES ABBAYES, Rennes, France).
- Collema* (G. DEGELIUS, Gothenburg, Sweden).
- Foliicolous lichens (R. SANTESSON, Uppsala, Sweden).
- Leptogium*, sect. *Mallotium* (M. MITCHELL, Galway, Ireland).
- \**Lichinaceae*, and other "cyanophilous lichens" (AINO HENSSEN, Marburg, Germany).
- \**Parmelia* (M. E. HALE, Washington, D.C., U.S.A., and S. KUROKAWA, Tokyo).
- Peltigera* (P. O. LINDAHL, Uppsala, Sweden).
- Physcia* (D. D. AWASTHI, Lucknow, India).
- Ramalina* (A. H. MAGNUSSON, [†], Gothenburg, Sweden).
- Siphula* (R. SANTESSON, Uppsala, Sweden).
- Stictaceae* (P. W. JAMES, London, England).
- Umbilicaria* (E. FREY, Bern, Switzerland, and G. A. LLANO, Washington, D.C., U.S.A.).
- Usnea* (J. MOTYKA, Lublin, Poland).

With the aid of these specialists, it will be possible to complete the lichen flora within a reasonable time.

\*Some results published. See Literature cited, p. 111.

## Survey of my Collecting in 1953

I arrived in Cape Town on July 11th and left on Dec. 18th. The main features of my itinerary are given in the table below and in the map (Fig. 1.).

Date	Division	Station	Collection Nos.
July 12	Wynberg	Cape Main road Newlands — Rondebosch, road-side trees (mainly <i>Quercus</i> )	fu 1, br 2, li 3—6, br 7—13 <sup>1</sup>
" 12	"	" Ibid., stonewall near Main Road	br 14—16
" 16	"	" Location E. of Kirstenbosch Botanical Garden, on <i>Quercus</i>	br 17—22, 57, li 23—52, fu 53—56
" 16	"	" Parking place in Kirstenbosch Bot. Garden, trunks and twigs of oaks	br 58—64, li 65—102, 104—110
" 16	"	" Ibid., smooth bark ( <i>Brabeium</i> , etc.)	fu 103, li 111—120
" 17	"	" Kirstenbosch Bot. Garden, near tea-room, boulders in rock garden	li 121—133
" 17	"	" Ibid., just above tea-room, near Skeleton Stream, trees ( <i>Quercus</i> , <i>Brabeium</i> , etc.)	li 133a—140, 143—147, 149—183, 189—249 br 141, 142, 148, 184—188, 250, 251
" 17	"	" Ibid., boulders near stream	li 252—290
" 18	"	" Ibid., on <i>Quercus</i> and <i>Brabeium</i>	li 291—351, 359—382, 403—439, br 352—358
" 18	"	" Ibid., boulders near stream	li 383—400, br 401, 402
" 19	Bellville	" Melkbosch Strand, dunes	ph 1—39
" 19	"	" Ibid., shrubs ( <i>Euphorbia</i> , <i>Putterlickia</i> , etc.) in dunes	li 440—445, 447—455, 457—475, br 446, fu 456
" 19	"	" Ibid., marine rocks (scanty lichen vegetation)	li 476
" 19	"	" Blaauwberg Strand, marine rocks (rich lichen vegetation)	li 477—506
" 20	Wynberg	" Kirstenbosch, along Skeleton Stream up to c. 1000', oaks	fu 507, br 508—512, 538, 539 li 513—537, 540—546
" 20	"	" Ibid., rocks	li 547—560, 569—593, 616—634
" 20	"	" Ibid., rocks in the stream	li 561—567, br 568, 635—638
" 20	"	" Ibid., dry ground near tree limit, c. 1000—1500'	ph 39a—51
" 20	"	" Ibid., trees and shrubs	li 594—615
" 22	"	" Kirstenbosch, Old Hostel, rocks near Window stream	li 639—804
" 22	"	" Ibid., old oaks	li 805—812
" 22	"	" Ibid., twigs of shrubs	li 813—828
" 23	Cape	" Camps Bay Road, near Kloof Nek, c. 600', rocks	li 829—864
" 23	"	" Above Round House, near Kloof Nek, c. 400', mainly rocks	li 865—914

<sup>1</sup> al=algae, br=bryophytes, fu=fungi, li=lichens, ph=phanerogams and ferns.

Date		Division		Station	Collection Nos.
July	23	Cape	Cape	Ibid., stone-wall	br 915
"	23	"	"	Hottentots Huise (S. of Camps Bay), rocks near shore	li 916—966, br 967
"	24	Wynberg	"	Kirstenbosch, above Old Hostel, near Window Stream, rocks	li 968—999, br 1025—1039, 1045
"	24	"	"	Ibid., oak trunks	li 1000—1022, 1040— 1044, 1046, br 1023, 1024
"	24	"	"	Ibid., smooth bark ( <i>Brabeium</i> , etc.)	li 1048—1103
"	24	"	"	Ibid., shrubs	li 1104—1149
"	24	"	"	Ibid., along Window Stream	ph 52—55
"	25	"	"	Near Witsandsbay, by road-side	ph 56—67
"	25	"	"	Kommetjie, on <i>Acacia</i>	li 1150—1167
"	25	"	"	Ibid., marine rocks	li 1168—1183
"	25	"	"	Witsandsbay, on <i>Acacia</i> and <i>Rhus</i>	li 1184—1193
"	25	"	"	Ibid., stone-posts and rocks by road-side	li 1194—1288, 1290— 1332 br 1289
"	29	"	"	Kirstenbosch, near Window Stream,	ph 68—71
"	29	"	"	Ibid., oaks	li 1333—1424, 1427, br 1425, 1426
"	29	"	"	Ibid., rocks	li 1428—1492, br 1493
"	30	"	"	Southern Cross Estate (between Kirstenbosch and Hout Bay), oaks	li 1494—1541, fu 1542
"	30	"	"	Ibid., rocks	li 1543—1549
"	30	"	"	Chapman's Point, steep rocks by road	li 1550—1573
"	30	"	"	Nordhoek, on <i>Populus</i> by road	li 1574—1578
"	31	"	"	Kirstenbosch, near Protea Garden	ph 72—76, li 1579
"	31	"	"	Ibid., leaves of <i>Protea</i>	fu 1580—1600
"	31	"	"	Ibid., on <i>Acacia</i> and <i>Euphorbia</i>	li 1601—1625
Aug.	1	Simonstown	"	Smitswinkelbay, rocks	li 1629—1633
"	1	"	"	Rooihogte, rocks	li 1634—1638
"	1	"	"	Cape of Good Hope, dry ground	ph 77—94
"	1	"	"	Ibid., marine rocks	li 1639—1668
"	2	Wynberg	"	Groot Constantia, on <i>Catodendron</i>	li 1669, 1670
"	3	"	"	Kirstenbosch, near Window Stream, rocks	li 1671—1721
"	4	Cape	"	Table Mt., near Upper Cableway station, rocks and soil	li 1722—1762
"	4	"	"	Ibid., twigs of small shrubs	li 1763—1766
"	5	"	"	Along Blinkwater Ravine	ph 95—116
"	5	"	"	Ibid., mainly rocks	li 1767—1891
"	9	"	"	Table Mt., near Upper Cableway Station, mainly rocks and soil	li 1892—1944, 1946 1957 br 1945
"	10	Stellenbosch	"	Jonkershoek, rocks and trees	li 1958—1984
"	11	Puurland	"	Between Helshogte and Franschoek, oaks by road	li 1985—2008, 2011, 2012, fu 2009, 2010
"	11	"	"	Fransch Hoek, wet ground near road	ph 117—131, li 2013—2017

Date	Division	Station	Collection Nos.
Aug. 11	Paarl	Cape Between Fransch Hoek and Villiersdorp, rocky ground by road, c. 1800'	ph 132—136 li 2018—2024
" 11	Caledon	" 10 miles E. of C., roadside just W. of Riviersonderend	ph 137—159
" 11	"	" Ibid., oak by road	li 2025—2062, br 2063
" 11	Swellendam	" Between Stormsvlei and Sw., rocks by road	li 2064—2082
" 12	"	" Garden in the N. part of Sw., old oaks	li 2083—2116, br 2117—2119
" 12	"	" Ibid., shrubs	li 2120—2150
" 12	"	" Ibid., trees (smooth bark)	li 2151—2173
" 12	"	" Grootvadersbosch (W. of Zuurbraak), on <i>Acacia</i> , etc.	li 2174—2230, 2236— 2270, br 2231—2235
" 12	"	" Ibid., rocks	li 2271, 2272
" 13	Riversdale	" Just W. of Albertinia, roadside	ph 160—182
" 13	Mossel Bay	" Just E. of M. B., sea-shore	ph 183—184, al 185
" 13	"	" Ibid., marine rocks	li 2273—2295
" 13	George	" Outeniqua Pass, c. 2400', wet rocks on the W. side of road	ph 186 li 2296—2314
" 13	"	" Ibid., trees (smooth bark)	li 2315—2345, br 2346
" 14	"	" Main road 7 miles E. of G., ravine near bridge, flat rocks	li 2347—2399
" 14	"	" Between Wilderness and Knysna, roadside	ph 187—189
" 14	Knysna	" Coney Glen, opposite "The Heads", steep rocks near shore	li 2400—2596
" 15	"	" Knysna Forest, 6 miles N. of Kn., road to Uniondale, trees ( <i>Quercus</i> , <i>Acacia</i> , etc.)	li 2597—2839 (except br 2658, 2672, 2687, 2698)
" 15	"	" Deepwell Forest, 10 miles N. of Kn.	ph 190—198
" 16	"	" Ibid., smooth bark	li 2840—2874
" 16	"	" Keurboomsrivier, small forest near shore	ph 199—214
" 16	"	" Ibid., trees (mainly smooth bark)	li 2875—2964, fu 2965—2969
" 16	"	" Ibid., rocks by shore	li 2970—2983
" 16	"	" Plantation between Kn. and Plettenberg Bay, on <i>Pinus radiata</i>	li 2984—3013
" 18	"	" Coney Glen (see above), near tea-house, rocks and trees	li 3014—3031, 3033— 3082, br 3032
" 18	"	" Deepwall Forest (see above), smooth bark	li 3083—3153, br 3154—3157
" 18	"	" Ibid., on <i>Pinus radiata</i>	li 3158—3188
" 19	"	" Gouna Forest	ph 215—248
" 19	"	" Ibid., trees (mainly smooth bark and leaves)	li 3189—3303, br 3304, 3305, fu 3306—3314
" 21	"	" Buffelsnek Forest and Deepwalls, mainly smooth bark	li 3315—3542 (except 3377—3379, 3409), fu 3543—3547 br 3377—3379, 3409, 3548—3558

Date	Division		Station	Collection Nos.
Aug. 22	Paarl	Cape	Garden of Eden, trees (smooth bark and leaves)	li 3559—3567, 3570—3614 fu 3568, 3569, br 3615—3617
" 22	"	"	"Nature's Valley", E. of Groot-rivier Pass, trees	li 3618—3636, br 3637
" 23	Humansdorp	"	Stormsrivier, indigenous forest 1 mile E. of St., trees	li 3638—3676, br 3677—3680
" 23	"	"	Ibid., 3 miles E. of St., trees	li 3681—3722
" 23	"	"	Ibid., 5 miles E. of St., trees	li 3723—3743, fu 3744, 3745
" 23	"	"	Ravine by bridge over Blaauw-krantzrivier, rocks	li 3746—3790
" 24	"	"	Stormsrivier, Tzitzikama Forest, 2—3 miles N. of St., near "The Big Tree" ( <i>Podocarpus falcata</i> ), trees (bark and leaves)	li 3791—3937 (except fu 3863, 3864, br 3865—3876, 3905 3906)
" 24	"	"	Stormsrivier, coastal shrub forest, indigenous trees (bark and leaves)	li 3938—4005 (except fu 3953, 3954), br 4006
" 26	Albany	"	Dassies Krantz (nature reserve near Grahamstown), trees (bark and leaves)	li 4007—4048, 4051— 4053, fu 4049, 4050
" 26	"	"	Fern Kloof (near Gr.), wet ground	br 4054—4064
" 26	"	"	Grahamstown, near a Students' Residence	ph 249
" 27	Uitenhage	"	Near Coega, Karro vegetation	ph 250—270
" 27	"	"	Ibid., shrubs	li 4065—4125
" 28	Humansdorp	"	Stormsrivier, old oaks	li 4126—4154
" 28	"	"	Ibid., on <i>Acacia melanoxylon</i> (bark and leaves)	li 4155—4167, fu 4168
" 28	"	"	Near Stormsrivier Pass	ph 271—280
" 30	Oudtshoorn	"	Karoo vegetation 4 miles S.S.E. of O., dry ground	ph 281—284, li 4169—4278
" 30	"	"	Ibid., shrubs	li 4279—4290
" 31	"	"	Cango Caves, clay wall near the entrance (very dark situation)	br 4291
" 31	"	"	Karoo vegetation 4 miles N. of Cango Caves, on <i>Acacia</i> shrubs and stony ground	li 4292—4326
" 31	"	"	Zwartberg Pass, 4 miles S. of top of pass (4000'), rocks near road	ph 286, 287, li 4327—4360
" 31	"	"	Ibid., rocks near top (5500')	li 4361—4377
" 31	Prince Albert	"	N. part of Zwartberg Pass, near "Cathedral Rock", steep rocks (often dominated by <i>Derma-tiscum thunbergii</i> )	li 4378—4388
" 31	"	"	Karoo vegetation just N. of P.A.	ph 285
Sept. 1	"	"	8 miles S.E. of Prince Albert Road, sandy ground near main road	ph 288—297
" 1	Laingsburg	"	20 miles N.E. of L., sandy ground by main road	ph 298—303
" 1	"	"	5 miles S.W. of Touws River, sandy ground by main road	ph 304—306

Date	Division	Station	Collection Nos.
Sept. 1	Worcester	Cape	Just S.W. of De Doorns, sandy ground by main road ph 307—318
" 5	Cape	"	Camps Bay, near Blinkwater Stream, <i>Pronium</i> swamp by roadside ph 319—365
" 5	"	"	Roadside near Kloof Nek, rocks li 4389, 4390
" 5	"	"	Camps Bay, opposite Caltex garage, boulders near shore li 4391—4477
" 7	Wynberg	"	Rondebosch Common, sandy ground ph 366—417
" 8	"	"	Ibid. ph 417—421
" 11	Malmesbury	"	5 miles N. of M., roadside ph 422—440
" 11	Piquetberg	"	7 miles S.W. of Citrusdal, ravine near road to Eendekuil ph 441—453
" 11	"	"	Ibid., shrubs and rocks li 4478—4491, br 4492
" 11	Clanwilliam	"	5 miles S.W. of Citrusdal, roadside ph 454—457
" 11	"	"	3 miles S.W. of Citrusdal, N. side of the pass, roadside ph 458—462
" 11	"	"	Ibid., rocks li 4493—4504
" 12	"	"	Orchard in Cl., on <i>Vitis</i> li 4505a
" 12	"	"	Pakhuis Pass, 3 miles N.E. of Cl., Karroo vegetation ph 463—465, 468 471
" 12	"	"	Ibid., rocks near road li 4505—4581
" 12	"	"	4 miles S. of Cl., rocks and naked soil between road and Olifants River ph 466, 467, li 4582—4632
" 12	Van Rhynsdorp	"	Van Rhyns Pass (30 miles N.E. of Van Rhynsdorp) ph 472—490
" 12	"	"	Ibid., rocks li 4633—4675
" 12	"	"	30 miles N. of V.R., roadside ph 491—494
" 14	Namaqualand	"	4 miles N.W. of Garies, roadside ph 495—501
" 14	"	"	Hondeklip Bay, N. of harbour, dunes ph 502—520
" 14	"	"	Ibid., at sea-shore, shrubs li 4676—4709
" 14	"	"	10 miles N.W. of Garies, on <i>Acacia</i> by road li 4710 4739
" 15	"	"	15 miles S. of Springbok, dry rocky ground dominated by <i>Aloe dichotoma</i> ph 521—526
" 15	"	"	O'okiep, roadside in town ph 527—534
" 15	"	"	Between O'okiep and Springbok, roadside ph 535, 536
" 15	"	"	Ibid., rocks and dry ground by road li 4710 4810
" 16	"	"	1 mile N. of Kamieskroon, rocky ground W. of road ph 537, 538
" 16	"	"	Ibid., rocks and shrubs li 4811—4871
" 16	"	"	12 miles S. of Kamieskroon, rocks E. of road li 4872 4894
" 16	Van Rhynsdorp	"	2 miles N. of Nieuwerust, rocks and shrubs W. of road li 4895 4942
" 17	Clanwilliam	"	9 miles S. of Clanwilliam, rocks and sandy ground E. of road ph 539, 540, li 4913 4967
" 17	Hopefield	"	Saldanha Bay, rocks by Saldanha hotel, near shore li 4968 4985

Date		Division	Station	Collection Nos.
Sept.	17	Hopefield	Cape	Ibid., rocks and shrubs up to 60' alt. li 4986—5038
"	17	"	"	E. of Saldanha, rocks near shore li 5039—5042
"	17	"	"	Between Langebaan Road and Hopefield, roadside ph 541, 542
"	19	Wellington	"	Bains Kloof, road to Worcester, sandy ground ph 543—567
"	19	"	"	Ibid., near stream E. of Botanical Station, wet rocks li 5043—5092
"	20	"	"	Bains Kloof, along stream ph 568—581
"	20	"	"	Ibid., rocks and shrubs li 5093—5169 (except br 5143, 5144, 5166, 5167)
"	21	"	"	Bains Kloof, 4 miles N. of hotel, wet rocks li 5170—5229, br 5230—5245
"	21	"	"	Ibid., 5 miles S. of hotel, dry ground and rocks ph 581a—588, li 5246—5257
"	23	Stellenbosch	"	Platklip, dry ground ph 589—599
"	23	"	"	Ibid., flat rocks li 5258—5290, br 5291
"	23	"	"	Stellenbosch Flats, sandy soil and sandstone rocks ph 600—619, li 5292—5346, br 5347, 5348
"	25	Wynberg	"	Groot Constantia, oaks li 5349—5370
"	25	"	"	Kirstenbosch Bot. Garden, stone-wall near parking place li 5371—5387
"	26	Paarl	"	Paarl Rock, c. 1300', trees and soil ph 620—634, fu 5388—5391, li 5392—5401, 5403—5415, br 5405, 5416—5418
"	26	"	"	Ibid., near top, c. 2300', rocks and trees li 5419—5564 (br 5461)
"	27	Wynberg	"	Long Kloof (between Constantia Nek and Hout Bay), oaks by roadside li 5565—5598
"	29	Caledon	"	Between Albertyn and Aldak-rivier (N.W. of Hermanus), roadside ph 635—647
"	29	"	"	Hermanus, marine rocks in town li 5599—5640
"	29	"	"	Mossel Rivier, shore, marine rocks ph 648—651, li 5641—5725
"	29	"	"	3 miles E. of Mossel Rivier, wet ground by a cave ph 652—658
"	29	"	"	Ibid., rocks and trees li 5726—5762
Oct.	1	Laingsburg	"	9 miles S.W. of L., rocks near main road li 5763—5778
"	2	Victoria West	"	Three Sisters, roadside ph 659—666
"	2	"	"	Ibid., rocks li 5779—5787
"	3	Philippolis	O.F.S.	20 miles N. of Ph., rocks by road li 5788—5800
"	3	Trompsburg	"	Just N. of Tr., rocks by road li 5801—5828
"	3	Ventersburg	"	Just N. of V., rocks by road li 5829—5847
"	3	Vredefort	"	Oudewerpspruit, rocks by road li 5848—5877
"	5	Pretoria	Transv.	Zoological Garden in P., trees li 5877—5883
"	6	"	"	Near National Herbarium in P., trees li 5884, 5885, al 5886
"	7	Waterberg	"	2 miles N. of Warmbad, trees near road li 5887—5912
"	8	Zoutpansberg	"	Hills E. of "Punchbowl Inn", 9 miles N. of Louis Trichardt, c. 4500', rocks and trees li 5914—6233, 6243, 6285, 6287—6348, br 5913, 6234—6244, 6286, 6349—6355

Date	Division	Station	Collection Nos.
Oct. 8	Zoutpansberg, Transv.	Hills E. of "Punchbowl Inn"	ph 667, 667a
" 9		Hanglip Forest, 5 miles N.W. of Louis Trichardt, c. 5000', trees	li 6356—6381, 12000—12180, al 12181, br 6382—6400, 12182—12190
" 10	"	Overwinning, dry soil	ph 672—674
" 10	"	Between O. and Wyllies Poort, trees	li 6401—6409
" 10	"	Wyllies Poort, by a stream	ph 668—671
" 10	"	Ibid., rocks	li 6410—6429
" 10	"	Punchbowl Inn, cultivated trees in garden	li 6430—6477, br 6478, 6479
" 11	"	E. of Punchbowl Inn (=Oct. 8), mountain slopes	ph 675—677
" 11	"	Ibid., rocks and trees	li 6480—6603, 6608—6629, br 6604—6607
" 11	"	Hanglip Forest (=Oct. 9), rocks and trees	li 6630—6675, br 6676—6681
" 12	Pietersburg	Munnik (36 miles N.E. of P.), trees	li 6682—6692
" 12	Letaba	8 miles N. of Tzaneen, rocks and trees	li 6693—6700, 6703—6719, br 6701, 6702
" 12	"	Houtbosch, 6 miles N. of Tzaneen, rocks	li 6720—6766
" 12	"	Houtbosch, trees near road	li 6767—6792, br 6793—6795
" 12	"	"Forest Drive" between Houtbosch and Tzaneen, rocks, trees and naked soil	li 6796—6820, 6828—6850, br 6821—6827, 6851
" 15	Nelspruit	Kruger National Park, near Crocodile Bridge, dry soil	ph 678—685
" 16	Barberton	Komati River, $\pm$ wet rocks	li 6852—6858
" 16	Sul do Save Moç.	Polana Beach, 8 km. W. of Lourenço Marques, trees near shore	li 6859—6875
" 17	"	Lourenço Marques, near Hotel Clubo, trees	li 6876—6883
" 17	"	3 km. N. of Vila Luiza, (N. of L.M.), trees in a garden	li 6884—6927
" 17	"	18 km. S. of Manhica, trees in orchard near road	li 6928—6955, br 6956—6961
" 17	"	20 km. N. of Manhica, trees near road	li 6962—6980
" 18	"	8 km. E. of Impamputo (W. of L.M.), trees and rocks near road	li 6981—7105 (fu 7054, 7079—7081)
" 18	"	2 km. E. of Namaaqua, on cultivated <i>Cupressus</i>	li 7106—7167, al 7168, br 7169—7179
" 18	"	Between Boane and Namaaqua, near roadside	ph 686—696
" 18	"	Lourenço Marques, Botanical Garden, trees	li 7180—7211, br 7212—7214
" 20	Nelspruit Transv.	Gladde Spruit (just W. of Nelspruit), rocks in stream near bridge	li 7215—7224



Date	Division	Station	Collection Nos.
Oct. 20	Nelspruit	Transv. 20 miles S.E. of Lydenburg, roadside	ph 697—708
" 20	"	" Ibid., trees and rocks	li 7225—7291. br 7292—7298
" 20	Lydenburg	" 14 miles S.E. of L., trees and rocks	li 7299—7386
" 20	"	" 10 miles S.E. of L., roadside	ph 709—720
" 20	"	" Ibid., trees and rocks	li 7387—7434
" 21	"	" Wet indigenous forest 5 miles E. of Mokobulaan Forest Station, c. 6800', steep slopes	ph 721—740
" 21	"	" Ibid., rocks and trees in the forest	li 7435—7785, fu 7786, 7787, br 7788—7799
" 22	Pilgrims Rest	" The Berg, 5 miles W. of P.R., c. 5400', dry ground near road	ph 741, 742
" 22	"	" 4 miles S.E. of P.R., rocky ground near road	ph 743—761
" 22	"	" Ibid., rocks	li 7800—7838
" 22	"	" Mac-Mac Falls N. of Sabie, dry ground	ph 762—776
" 22	"	" Just S. of Sabie, rocky ground	ph 777
" 23	Barberton	" 7 miles E. of Havelock, dry ground near top of pass, alt. 6000'	ph 778—784
" 23	"	" Ibid., rocks	li 7839—7892
" 23	Peak	Swaziland Piggs Peak, on <i>Jacaranda</i> near police station	li 7893—7922, 7926. br 7923—7925
" 23	"	" 4 miles S. of Piggs Peak, dry ground	ph 785
" 23	Mbabane	" 15 miles S. of Piggs Peak, rocks near road	li 7927—7975
" 24	Paulpietersburg	Natal Just N. of PPB., near stream	ph 786—791
" 25	Vryheid	" 5 miles N. of Vr., dry ground near road	ph 792—794
" 25	"	" Ibid., steep rock W. of road	li 7976—8038
" 25	Nkandhla	" Indigenous forest S. of Nk.	ph 795—807
" 25	"	" Ibid., trees (also leaves)	li 8039—8243 (fu 8050, 8051, 8053 br 8244—8270)
" 25	Eshowe	" Dense indigenous forest near E., trees (also leaves)	li 8271—8459 (fu 8432, 8436, 8443, 8452), br 8460—8480
" 27	"	" E., near post office, on <i>Jacaranda</i>	li 8481—8491
" 27	"	" Square in middle of E., trees	li 8492—8522, br 8523 8524, al 8525
" 27	Mtunzini	" 1 mile N. of Tugela River, roadside	ph 808—816
" 28	Durban	" Botanical Garden in D., trees	li 8526—8540
" 29	Pietermaritzburg	" Bisley (4 miles S. of PMB.), "lowveld" with <i>Acacia</i> , <i>Combrctum</i> , etc.	ph 817—845
" 29	"	" Ibid., trees	li 8541—8545, br 8546—8552
" 29	"	" Ibid., sandy ground	ph 846—855
" 30	"	" Natal Table Mt., slopes and summit, dry ground	ph 856—896

Date	Division		Station	Collection Nos.
Oct. 30	Pietermaritzburg	Natal	Natal Table Mt., trees, rocks and soil	li 8553—8583, 8591—8634, br 8584—8590
" 31	Lions River	"	Howick, on <i>Jacaranda</i> in town	li 8635—8639
" 31	"	"	Boschfontein Forest near Balgowan	ph 897—899
" 31	"	"	Ibid., trees, rocks and naked soil	li 8640—8647, 8650—8791, fu 8792, br 8648, 8649, 8793—8809
" 31	"	"	Caversham Falls, wet rocks in river	ph 900
Nov. 2	Bergville	"	Just W. of Cathedral Peak Hotel, alt. c. 4500', dry ground	ph 901—912
" 2	"	"	Ibid., rocks	li 8810—8833
" 2	"	"	Indumeni Forest (wet indigenous forest c. 1.5 mile S.E. of C.P. Hotel), alt. c. 5500'	ph 913—916
" 3	"	"	Ibid., trees and rocks	li 8834—8902, 8929—9006, 9010—9024, br 8903, 8904, 8906—8928, 9007—9009, 9025, 9026, al 8905
" 4	"	"	Organ Pipes in the Cathedral Peak Mts. (c. 5 miles S. of C.P. Hotel), alt. 6500—9000', dry ground	ph 917—928
" 4	"	"	Ibid., rocks and naked soil (few cryptogams, no <i>Umbilicaria</i> or <i>Usnea</i> )	li 9027—9113, br 9114—9119
" 5	"	"	1 mile W. of C.P. Hotel, dry ground	ph 929—932
" 5	"	"	Ibid., rocks and shrubs	li 9120—9182
" 6	"	"	Indumeni Forest, alt. c. 6000', dry ground	ph 933—949
" 6	"	"	Ibid., rocks and trees	li 9183—9289, 9304—9373, br 9290—9302
" 7	"	"	Cathedral Peak area, along "Mountain Road" (c. 2 miles S. of Forester's Office), alt. c. 5000', dry ground	ph 950—955
" 7	"	"	Ibid., rocks and trees	li 9374—9401, br 9402—9404
" 8	Bergville	"	Oqualweni Forest (2 miles W. of C.P. Hotel), near stream	ph 956
" 8	"	"	Ibid., rocks and trees	li 9405—9459, br 9460—9475
10	Polela	"	Polela Forest (near Bulwer), on trees	li 9476—9610, 9616—9627, br 9611—9615
" 10	Pietermaritzburg	"	14 miles S.W. of PMB., naked soil by roadside	li 9628
" 12	"	"	Botanical Garden, trees	li 9629—9680, br 9681—9684
14	Inanda	"	Umhlanga Rocks (N. of Durban), marine rocks (very scanty lichen vegetation)	li 9725

Date	Division		Station	Collection Nos.
Nov. 14	Inanda	Natal	Umhlanga Rocks, N. of Durban, trees	li 9685—9724. 9726.
" 15	Durban	"	Isipingo Rocks (S. of D.), dense mangrove vegetation near shore	9727 ph 957 973
" 15	"	"	Ibid., marine rocks (few lichens: no <i>Roccella</i> , <i>Xanthoria</i> or <i>Caloplaca</i> )	li 9728—9762 (br 9752)
" 15	"	"	The Bluff, Fynnland, small grove near road, trees and shrubs	li 9763—9804. br 9805—9811
" 18	Umzinto	"	Hibberdene (20 miles N. of Port Shepstone), near road	ph 974—976
" 18	"	"	Ibid., rocks and trees	li 9812—9866
" 18	"	"	1 mile N. of Umzumbi, dry ground near road	ph 977—980
" 18	Port Shepstone	"	Ibid., trees and naked soil	li 9867—9903
" 18	"	"	Anerley Beach (4 miles N. of P.S.), marine rocks (few lichens: no <i>Roccella</i> or <i>Xanthoria</i> )	li 9904—9926
" 19	Alfred	"	Impetyne Forest (near Weza), (fairly wet indigenous forest), alt. c. 3500'	ph 981—983
" 19	"	"	Ibid., trees (also leaves), rocks and naked soil	li 9927—10204. br 10205—10242
" 20	"	"	Ingele Forest (c. 15 miles E. of Kokstad), trees (also leaves) and rocks	li 10243—10400. (br 10331—10333)
" 20	Flagstaff	Cape	Near Emagusheni (c. 20 miles S.S.E. of Kokstad), large boulder near road	li 10401—10422
" 21	Port St. Johns	"	2 miles N.W. of P. St. J., indigenous forest near road, mainly trees	li 10423—10481. br 10482—10485
" 21	"	"	Ibid., 5 miles from P. St. J., same forest, trees	li 10486—10543. br 10544
" 21	"	"	Ibid., on <i>Pinus</i> in avenue near road	li 10545—10569. br 10570
" 21	"	"	Ibid., 8 miles from P. St. J., indig. forest, trees (also leaves)	li 10571—10602. br 10603—10606
" 21	"	"	P.St.J., 1st Beach, marine rocks	li 10607—10651
" 24	East London	"	Queen's Park in E.L., trees	li 10652—10660
" 24	"	"	13 miles N.W. of E.L., <i>Acacias</i> by road	li 10661—10679
" 24	"	"	2 miles N.W. of Potsdam, boulders near road	li 10696
" 24	Peddie	"	17 miles S.W. of Kingwilliams-town, trees (i.e., <i>Euphorbia</i> ) near road	li 10697—10713. br 10714
" 24	"	"	Along road 5—10 miles N.E. of Peddie, dry ground	ph 984—987
" 25	Albany	"	Fern Kloof, indigenous forest	ph 988—1000
" 25	"	"	Ibid., trees (also leaves)	li 10715—10814. 10832—10857. br 10815—10831
" 25	"	"	Near Milne House in Grahams-town, on <i>Jacaranda</i>	li 10858—10863

Date	Division	Station	Collection Nos.
Nov. 28	Knysna	Cape 2 miles W. of Blaauw Krantz Pass, indigenous forest near main road, trees	li 10864—10888, br 10889—10899
" 29	"	" Near "The Heads", dry ground	ph 1001—1002
" 29	"	" Deepwalls, 12 miles N. of Kn., near "The Big Tree" ( <i>Podocarpus falcata</i> ), indigenous trees	li 10900—10980, 11006—11092, br 10981—11004, 11094—11105, fu 11005, 11093
" 29	"	" Ibid., dry ground	ph 1003—1013
" 30	George	" 2 miles W. of G., roadside	ph 1014—1016
" 30	Mossel Bay	" 2 miles W. of M., roadside	ph 1017—1020
" 30	Riversdale	" 5 miles W. of Albertinia	ph 1021—1051
Dec. 2	Caledon	" Wild Flower Garden in C., rocks and trees	li 11106—11125, br 11126
" 6	Wynberg	" E. slopes of Table Mt. (along Skeleton Stream up to water reservoir), most collections 2000—2500'	ph 1052—1070
" 6	"	" Ibid., rocks and trees (also leaves)	li 11127—11378 (br 11297—11307)
" 8	Stellenbosch	" Jonkershoek, near Forest Station, dry ground	ph 1071
" 8	"	" Ibid., rocks and trees	li 11379—11441 (br 11409—11419)
" 13	Simonstown	" N. of Cape Point, between road and shore, sandy ground	ph 1072—1162
" 13	"	" Ibid., rocks and shrubs near shore	li 11442—11518

N. B. An additional series (nos. 12000—12190) is inserted on Oct. 9th (see above).

### Historical Sketch

LINNAEUS (1771 p. 311) was the first to record a lichen from South Africa, viz. *Lichen chrysophthalmus* [now known as *Teloschistes chrysophthalmus* (L.) Th. Fr.] from the manuscripts of the Danish botanist J. G. KOENIG as growing at the Cape of Good Hope ("Caput bonae Spei"). C. P. THUNBERG ("the father of the South African botany") spent 3 years (1772—1775) at the Cape. In his large botanical collections there are also a number of lichens. LINNAEUS fil. (1781 p. 451) described 4 species of lichens from "Cap. bonae spei", viz. *Lichen flammeus* ["e museo D. MONTIN"; now=*Xanthoria flammea* L.f.] Hillm., *Lichen viridis* ["leg. Thunb."; now=*Dermatiscum thunbergii* (Ach.) Nyl.], *Lichen verrucosus* ["leg. Thunb."; now=*Siphula*

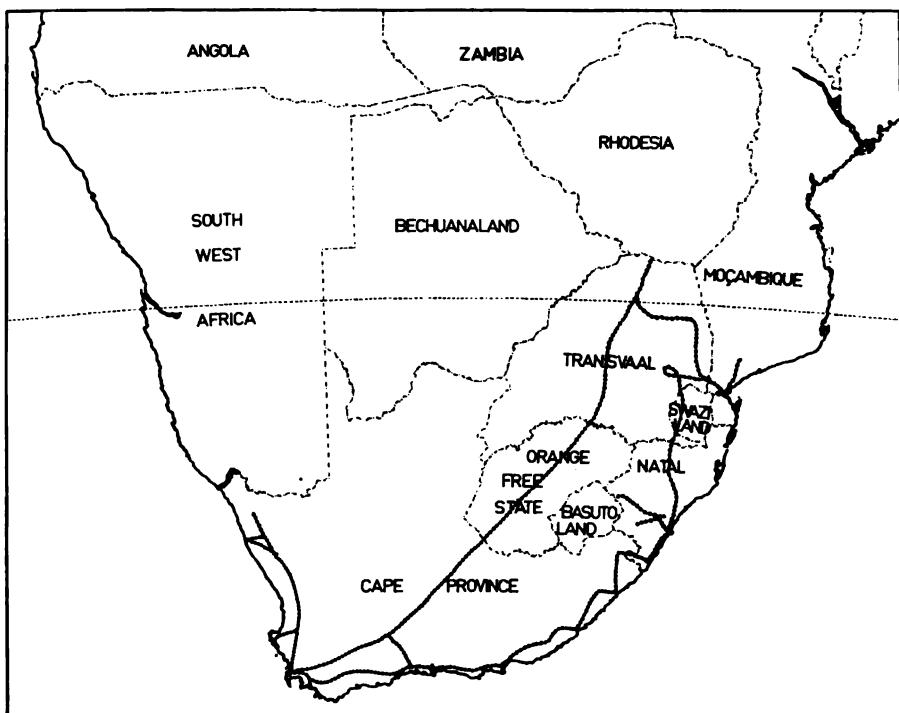


Fig. 1. The author's itinerary in 1953.

*verrucigera* (J. F. Gmel.) R. Sant.,<sup>2</sup> and *Lichen capensis* ["leg. Thunb."; now=*Teloschistes capensis* (L.f.) Vain. ex Müll. Arg.].

In his fundamental works on the Cape Flora (1800 pp. 175—180, 1823 pp. 741—750) THUNBERG listed a total of 39 lichen species. Most of these were described by E. ACHARIUS (1798, 1803, 1810, 1814). The best material for selecting lectotypes of the THUNBERG lichens is at Uppsala. The THUNBERG herbarium contains 29 species (32

<sup>2</sup> *Siphula verrucigera* (J. F. Gmel.) R. Sant. ined. — *Lichen verruciger* J. F. Gmelin, C. LINNÉ, Syst. Naturae "Ed. 13". Vol. 2: 2. 1377. 1792 (not 1791, as quoted in ZAHLBR. Cat. Lich. 6. 617. 1930.)

Syn. *Siphula tabularis* (Ach.) Nyl. — *Lichen tabularis* Thunb. ex ACH. Lichenogr. succ. prodrom. 90. 1798 (nom. superfl.)

*Lichen verrucosus* L. fil., Syst. plant. 451. 1781 is a younger homonym of *L. verrucosus* Huds. Flor. angl. 445. 1762 [= *Pertusaria pertusa* (L.) Tuck. and *P. hymenea* (Ach.) Schaer.], *L. verrucosus* Huds. Flor. angl. ed. 2. 545, 1778 [= *Lobaria scrobiculata* (Scop.) DC.] and *L. verrucosus* Web. Spicil. Flor. Goetting. 273. 1778 [= *Peltigera aphthosa* (L.) Willd.]. The record of a "*Lichen verrucosus* L." (pater) in ZAHLBR. Cat. l.c. is wrong.

specimens) of lichens recorded from S. Africa. (Cf. JUEL 1918 p. 49.) Some THUNBERG material is also in the ACHARIUS herbarium at Helsinki and in a set of Acharian lichens now preserved in the British Museum in London.

For a detailed historic account of the lichenology in S. Africa up to the 1940's, I refer to the important work by DOIDGE (1950 p. 18). Some further information has been added by MATTICK (1956 p. 487).

DOIDGE (l.c. p. 225—376) compiled a fairly complete list of all lichens reported from Southern Africa (up to 15°S), including the present Republic of South Africa, Basutoland, Swaziland, Bechuanaland, S.W. Africa, Rhodesia (formerly S. Rhodesia) and the southern parts of Zambia (formerly N. Rhodesia), Malawi (formerly Nyasaland), Portuguese E. Africa, and Angola. The records were taken from the literature and, to a less extent, from unpublished determinations of material in herbaria in S. Africa (Cape Town, Pretoria, Stellenbosch) and England (British Museum, Kew). All known localities were recorded for each species, and detailed literature references were given. There are, however, no descriptions nor any taxonomic revision of the material. Nevertheless, it is an indispensable account of what was known about the lichen flora of S. Africa up to 1945.

VAN DER BYL (1933 a,b; 1935 a,b) started a series of surveys of some lichen groups in S. Africa, viz. *Roccellaceae*, *Teloschistaceae*, *Cladoniaceae*, *Ramalina*, and *Collemataceae*; in all 73 species. He included keys, short descriptions, records of distribution and ecology, and photographs of the species. His data unfortunately were based on limited material (as a rule determined by STIZENBERGER, MÜLLER ARG., VAINIO, ZAHLBRUCKNER et al.). His descriptions were compiled from various authors, and there is no critical taxonomic revision of the species. VAN DER BYL's papers are still the only attempt at a lichen flora of Southern Africa.

DOIDGE (l.c.) recorded 1159 species, 205 varieties and 92 forms. The number of species is fairly high if we consider that many districts of Southern Africa have no or a scarce tree vegetation and thus lack most of the epiphytic lichens. For comparison may be given some totals from other groups of cryptogams: *Ascomycetes* 835 spp., *Basidiomycetes* 1704 spp. (both sec. DOIDGE l.c.), *Hepaticae* 298 spp. (among them 133 endemes) in the Republic only (sec. ARNELL 1963), *Pteridophyta* c. 300 spp. (communication from Dr. E. A. SCHELPE). Compared to the number of phanerogamic plants, however, about 18000 spp. in the Republic alone, the number of lichens is remarkably low.

It is already evident that at least 200 lichen species hitherto unknown from S. Africa will be added to the flora, but, on the other hand, I believe that taxonomic revisions will reduce the number of species to an even greater extent, so that the total number will probably not exceed 1000.

Some data on the number of localities, in which certain lichen species are known, may be quoted, in order to show how far our knowledge of the South African lichen flora has been extended during the last two decades.

Vague records, as "Cape", "C. B. Sp.", etc., are not included.

	Number of stations sec. DOIDGE 1950	Number of stations known by the present author
<i>Normandina pulchella</i>	2	30
<i>Byssoloma rotuliforme</i>	0	6
<i>Nephroma helveticum</i>	2	22
<i>Dermatiscum thunbergii</i>	5	16
<i>Candelaria concolor</i>	4	69
<i>Parmelia crinita</i>	0	19
— <i>reticulata</i>	1	98
<i>Usnea pulvinata</i>	14	52
<i>Teloschistes capensis</i>	3	35

### Phytogeographical Sketch

In spite of our increased knowledge of many species, it is still premature to draw any far-reaching conclusions on the phytogeography of the Southern African lichens. The great majority of lichen species recorded from Southern Africa are imperfectly known as to taxonomy and distribution and cannot be included in any phytogeographical pattern.

It is possible, however, to distinguish some distributional groups. It should be pointed out that they have been selected according to somewhat different principles, and hence they are partly overlapping.

1. Ubiquitous species with a  $\pm$  worldwide distribution. They are well represented also in South Africa without any distinct phytogeographical tendency, e.g.,

*Buellia punctata*

*Candelaria concolor* (fig. 16)

*Lobaria pulmonaria*

*Peltigera canina*

*Physcia stellaris*

A number of lichens common in the N. hemisphere are absent in S. Africa, e.g., *Cladonia rangiferina*, *Parmelia physodes*, *P. sulcata* and

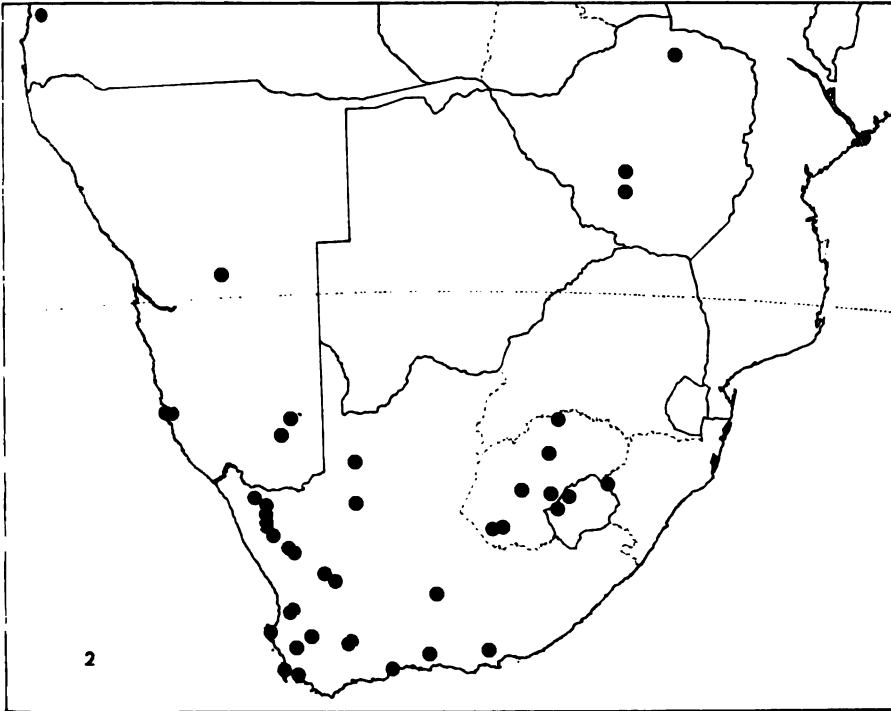


Fig. 2. *Acarospora schleicheri* (Ach.) Mass. World-wide distribution in arid districts, mainly subtropical. Also in S. Europe. Cf. MAGNUSSON 1929 p. 79 and 395 (map).

the genera *Cetraria* and *Evernia*. Others are rarely represented, e.g., the genera *Alectoria* and *Stereocaulon*. [LAMB (1953 p. 416) recorded 3 species of *Stereocaulon* from S. Africa.]

2. Steppe and desert species. A considerable number of saxicolous and terricolous species have their distribution concentrated in the arid districts of S.W. Africa, Namaqualand, Kalahari, and Karroo, e.g.,

*Acarospora fuscata*  
— *schleicheri* (fig. 2)  
*Diploschistes actinostomus*

*Heppia euploca*  
*Lecidea decipiens*  
*Parmelia hottentotta*

Many of them are species characteristic of arid districts in all parts of the world.

3. Montane species, as a rule saxicolous or terricolous, usually met with only at high altitudes, preferably more than 1000 m.s.m., e.g.,



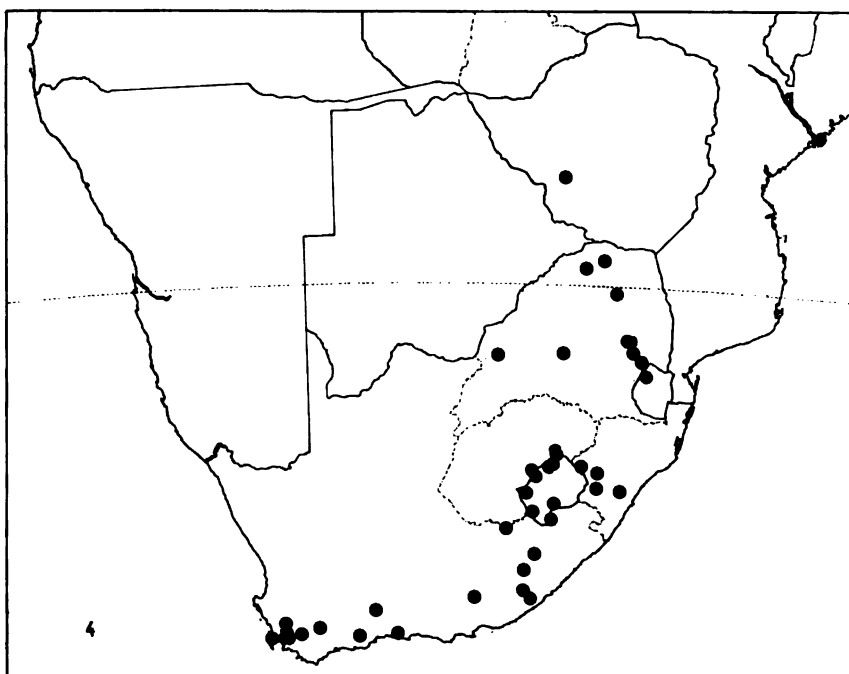
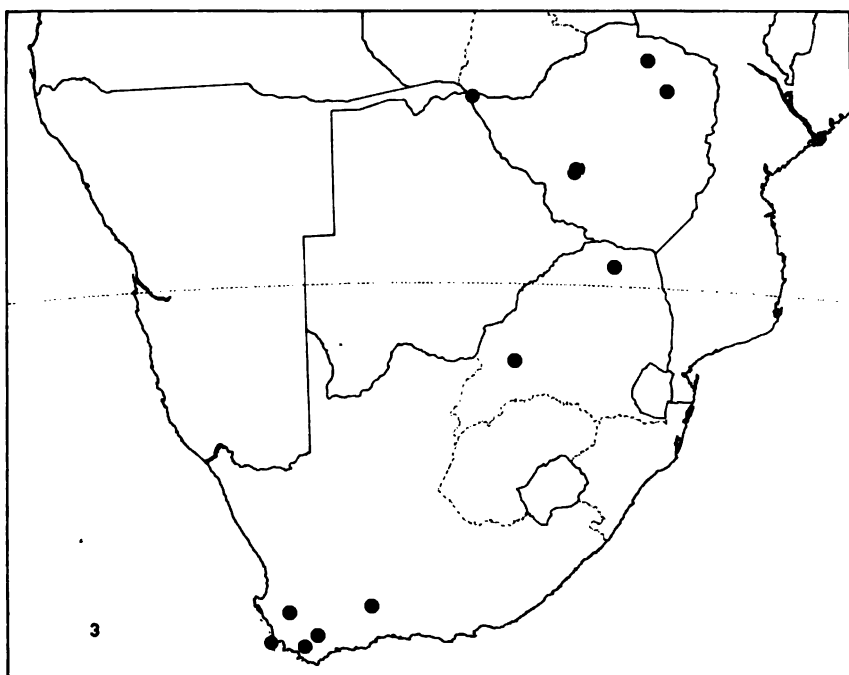


Fig. 3. *Dermaticum thunbergii* (Ach.) Nyl. Also known from Madagascar.  
 Fig. 4. *Usnea pulvinata* Fr. Also in Central Africa, Madagascar and Australia.  
 Cf. Мотыка 1936—1938 p. 319.

<i>Dermatiscum thunbergii</i> (fig. 3)	<i>Umbilicaria</i> (s.lat.) spp. (Cf. FREY 1949 p. 425)
<i>Pertusaria leonina</i>	
<i>Placopsis gelida</i> (fig. 18)	<i>Usnea pulvinata</i> (fig. 4)
<i>Rhizocarpon geographicum</i>	<i>Xanthoria elegans</i>
<i>Solorina saccata</i> (fig. 17)	— <i>fallax</i>
<i>Stereocaulon</i> spp. (Cf. LAMB l.c.)	

4. Oceanic species, predominant in the  $\pm$  humid wooded districts in the South and the East, e.g., the slopes of Table Mt., the Knysna district, the Grahamstown district, the S. and E. slopes of the Drakensberg Mts, and the Transvaal Mts. The annual rainfall amounts to c. 800—2000 mm. spread over most part of the year. A considerable number of species belong here, many of them with a  $\pm$  world-wide distribution in oceanic districts in all parts of the world, e.g.,

<i>Anaptychia leucomelaena</i>	<i>Pseudocyphellaria aurata</i>
<i>Normandina pulchella</i> (fig. 5)	— <i>crocata</i>
<i>Pannaria rubiginosa</i>	<i>Sticta fuliginosa</i>
<i>Parmelia austrosinensis</i> (fig. 7)	<i>Teloschistes flavicans</i>
— <i>crinita</i> (fig. 8)	<i>Usnea rubiginea</i> (fig. 6)
— <i>reticulata</i> (fig. 9)	

5. Tropical-oceanic species, mainly restricted to N. Natal (Zululand), E. Transvaal and Moçambique. This district, where sugar-cane, pineapple and other important crops are cultivated, has a high mean annual temperature (winters much milder than in the Cape area) and a fairly high annual precipitation. A certain number of lichens belong here, e.g.,

<i>Coccocarpia pellita</i>	<i>Parmelia andina</i> (fig. 10)
<i>Glyphis cicatricosa</i>	— <i>dilatata</i> (fig. 11)
<i>Graphina acharii</i>	<i>Strigula elegans</i> (fig. 12)
<i>Gyrostomum scyphuliferum</i>	and other foliicolous lichens.

6. Maritime species, restricted to the marine (or maritime) rocks constitute an ecological group not directly comparable to the previous ones, e.g.,

<i>Caloplaca granulosa</i>	<i>Dirina capensis</i>
— <i>sublobulata</i>	<i>Rocella arnoldii</i>
<i>Combea mollusca</i> (fig. 13)	— <i>hypomecha</i> (fig. 14)

The endemic species, represented within groups 2—6, afford a number of interesting problems.

Among the 1159 lichen species recorded by DOIDGE, there are 4 genera, viz. *Combea* De Not., *Diploschistella* Vain., *Placothelium* Müll. Arg. and *Placynthiopsis* Zahlbr. (all monotypic), and some 300 species,

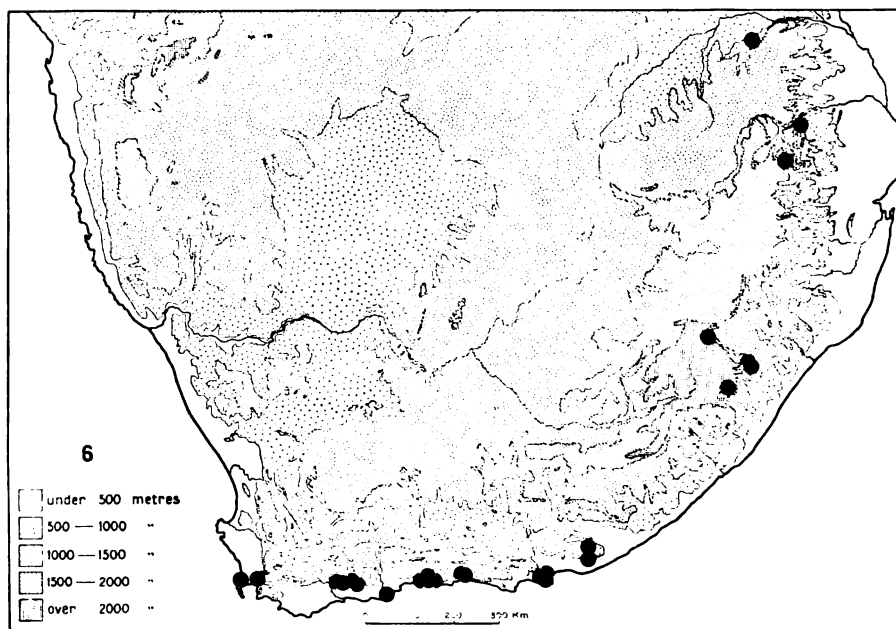
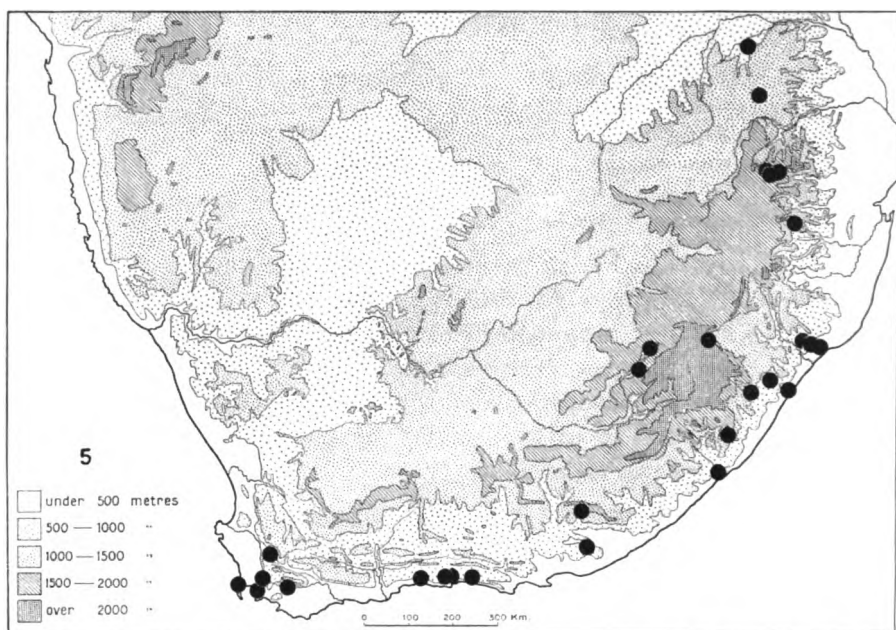


Fig. 5. *Normandina pulchella* (Borr.) Nyl. World-wide distribution, mainly in oceanic—suboceanic districts. Also in W. Scandinavia. Cf. DEGELIUS 1935 p. 101.  
 Fig. 6. *Usnea rubiginea* (Mich.) Mass. (incl. *U. rubescens* Stirt. and *U. rubicunda* Stirt.) World-wide distribution in oceanic districts. Also in W. Europe. Cf. MOTYKA 1936—1938 p. 342.

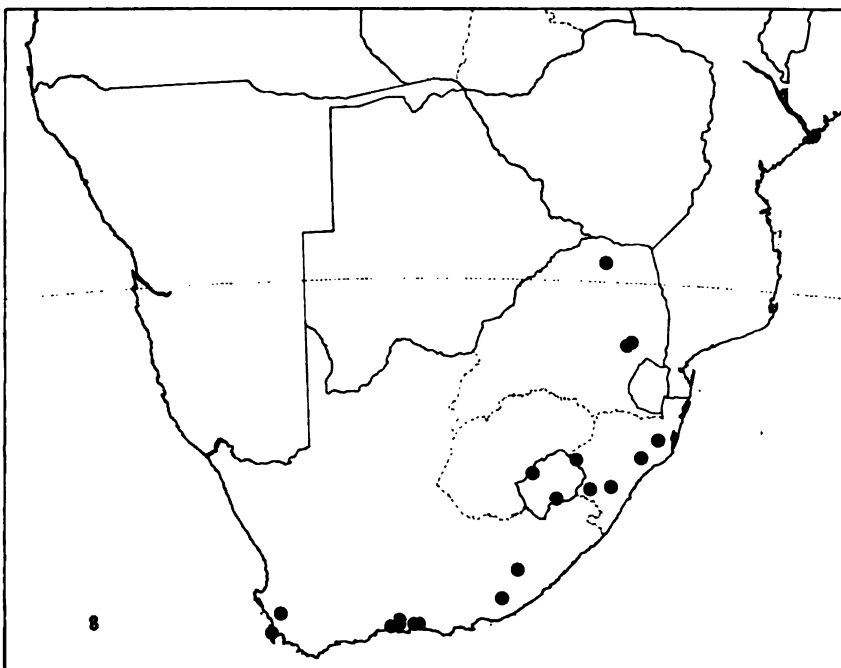
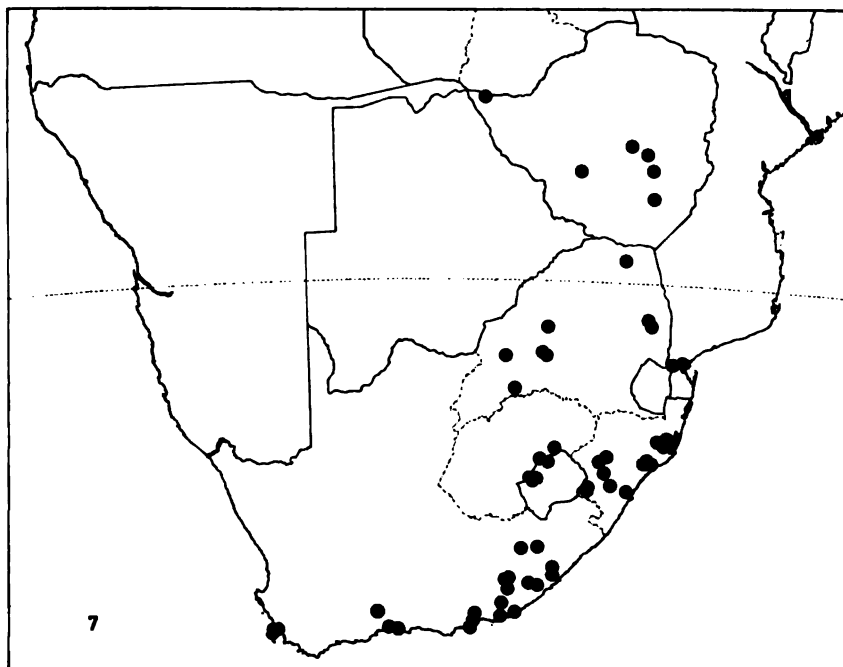


Fig. 7. *Parmelia austrosinensis* Zahlbr. Pantropical—oceanic distribution. Also in Portugal. Cf. HALE 1965 p. 204 (map) and 238.

Fig. 8. *Parmelia crinita* Ach. World-wide distribution in many oceanic districts. Also in W. Europe (incl. W. Norway). Cf. DEGELIUS 1935 p. 126. HALE 1965 pp. 222 (map) and 284.

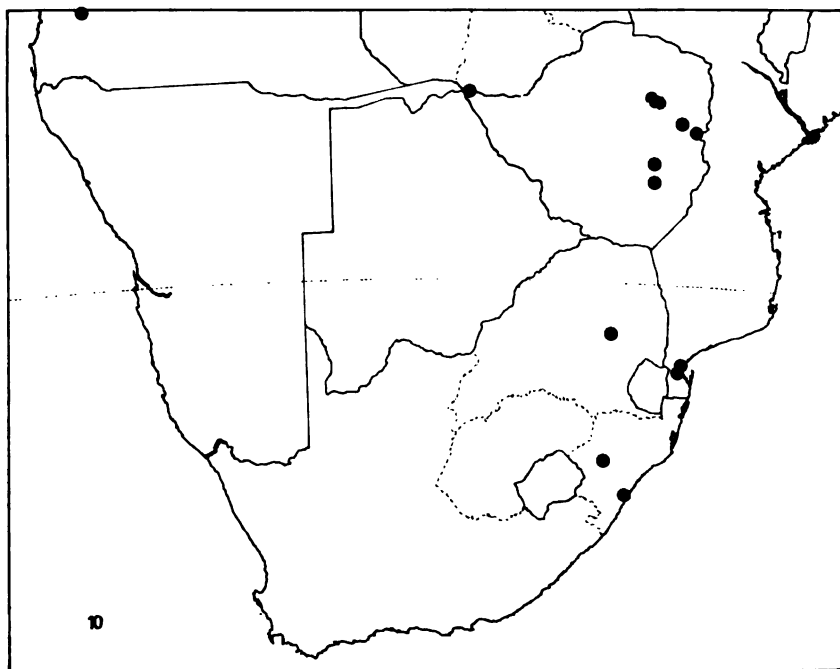
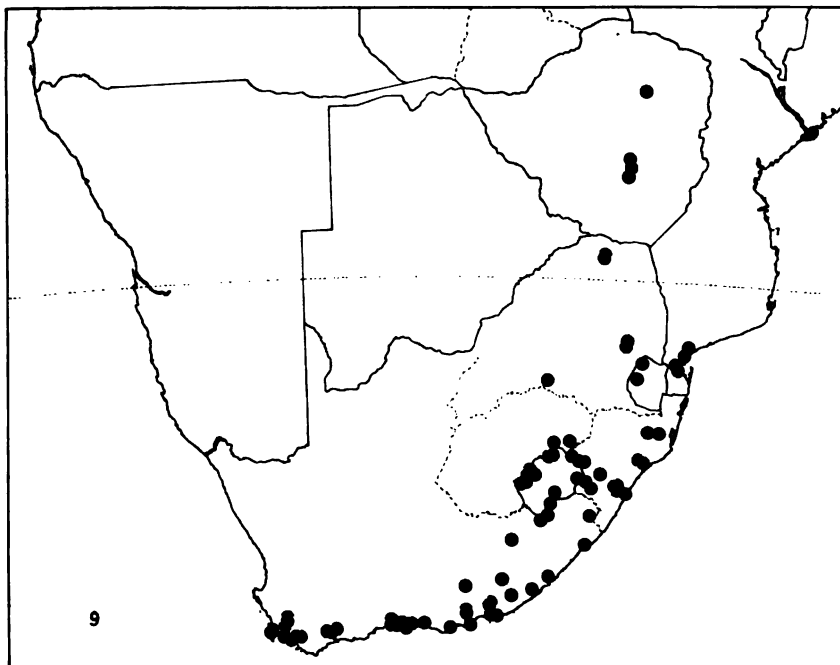


Fig. 9. *Parmelia reticulata* Tayl. World-wide distribution, mainly in oceanic districts. Also in S. and W. Europe.

Fig. 10. *Parmelia andina* Müll. Arg. Wide distribution, mainly in the tropical areas of the southern hemisphere. Cf. HALE 1965 pp.204 (map) and 236.

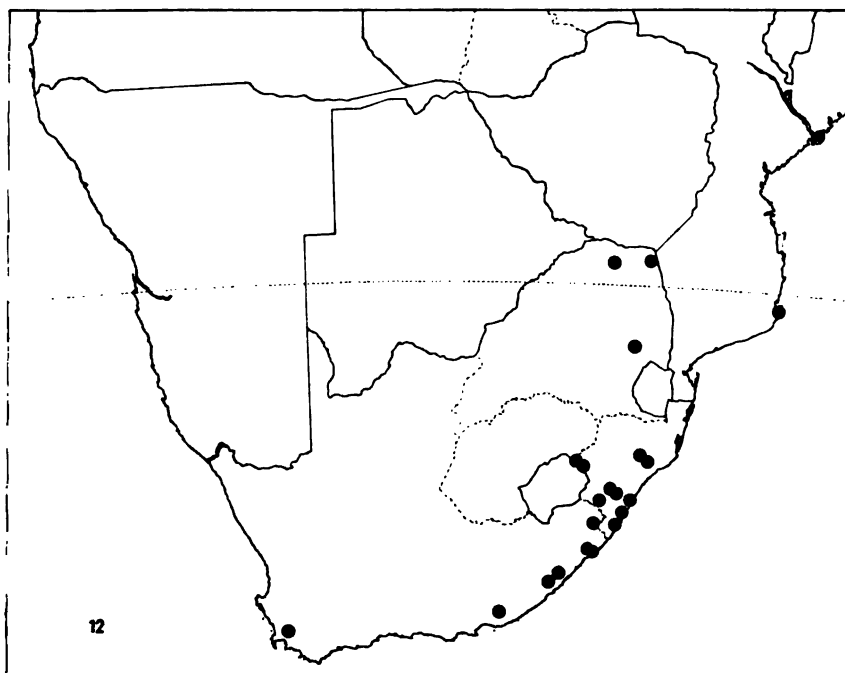
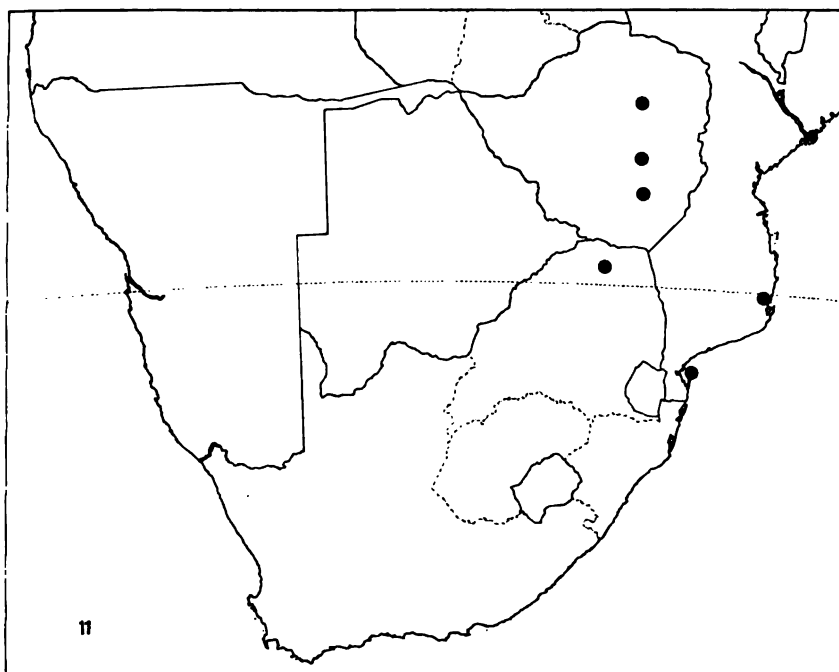


Fig. 11. *Parmelia dilatata* Vain. (Syn. *P. robusta* Degel.). World-wide distribution in oceanic districts. Also in W. Europe. Cf. HALE 1965 p. 246.

Fig. 12. *Strigula elegans* (Fée) Müll. Arg. World-wide distribution in tropical—subtropical districts. Also in France. Cf. SANTESSON 1952 p. 166.

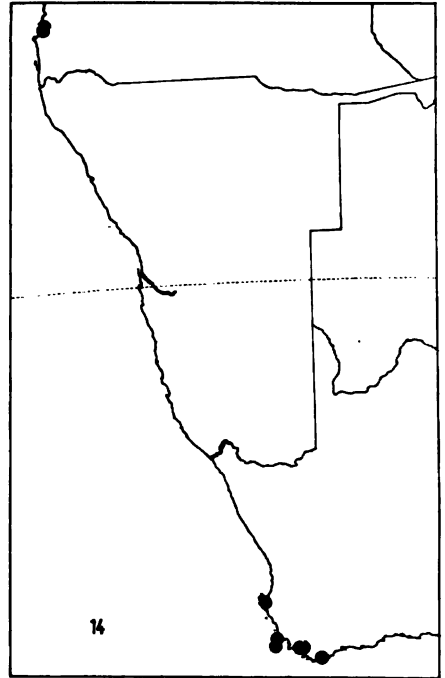
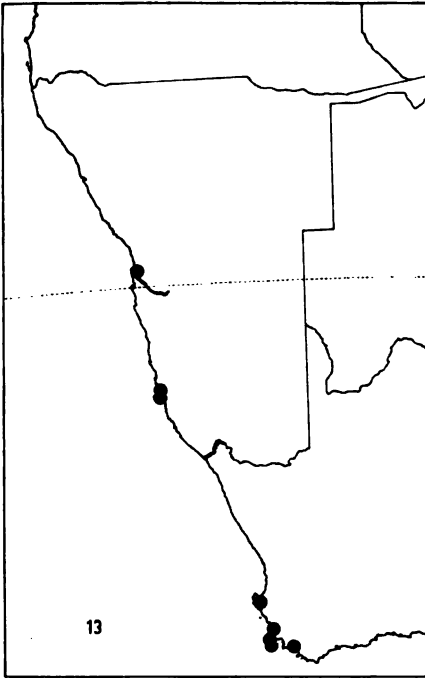


Fig. 13. *Combea mollusca* (Ach.) Nyl. Endemic.  
 Fig. 14. *Roccella hypomecha* (Ach.) Bory. Endemic.

which were considered as endemic in Southern Africa. Another monotypic endemic genus, *Eremastrella* Vogel, has been described recently from the Drakensberg area (VOGEL 1955 p. 104). Further research has shown that many of these species are identical to species known from other parts of the world, especially Central Africa and South America. The descriptions of several S. African "endemes", at least from the 19th century, are brief and vague, without comparison with related species, and the type collections are often scanty. Access to richer material has made it possible to reduce many of them to synonymy. This has especially been the case in the genera *Lecidea* (106 species listed by DOIDGE), *Acarospora* (36 spp.), *Parmelia* (128 spp.), *Caloplaca* (62 spp.), and *Buellia* (63 spp.).

There are a number of true endemes in the S. African lichen flora, e.g., *Combea mollusca* (Ach.) Nyl., *Parmelia hottentotta* (Ach.) Ach., *Siphula verrucigera* (J. F. Gmel.) R. Sant., *Teloschistes capensis* (L.f.) Vain., and *Toninia bumamma* (Nyl.) Zahlbr., several of them first

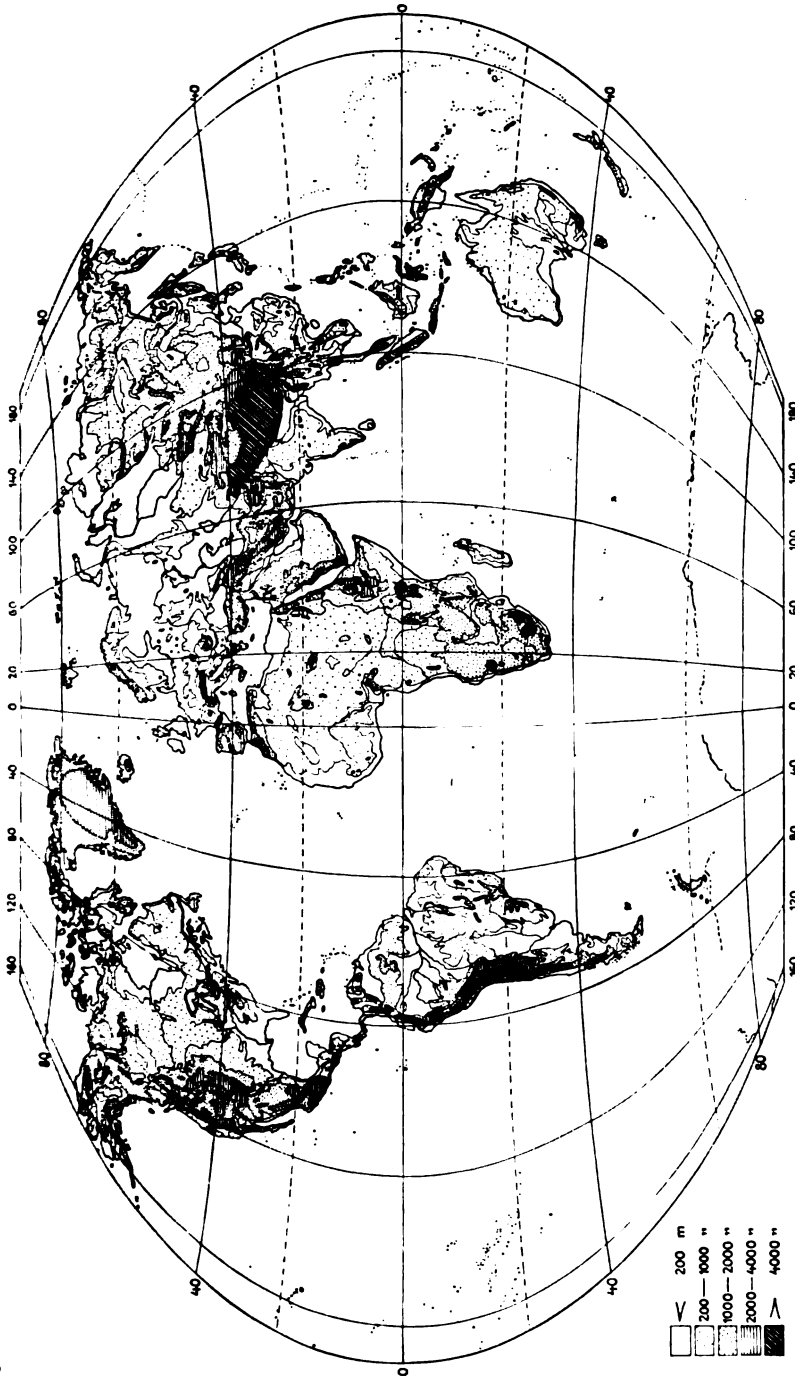
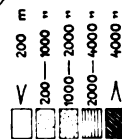


Fig. 15. *Catoplaea subnitida* (Malme) Zahlbr. Total distribution known.





recorded by THUNBERG. On the whole, however, such cases are exceptions to the general rule that the lichen flora has few equivalents to the rich number of endemic families, genera, and species among the phanerogams.

It will become more and more evident that S. Africa has many lichen species in common not only with Central Africa and the Mediterranean districts, which is not surprising, but also with S. America and Asia. It is probable that this south-hemispheric element, e.g., *Caloplaca sublobulata* (Nyl.) Zahlbr., *C. subnitida* (Malme) Zahlbr. (fig. 15), and *Parmelia andina* Müll. Arg. (total distribution mapped by HALE 1965 p. 204), will prove to have several representatives among the lichens.

For reasons mentioned above, it has proved necessary to compare the South African material with many species recorded from other parts of the world. This research has often been extended far beyond the scope of my earlier plans. In order to gain a reasonably sound taxonomic base, several groups are being treated more or less monographically.

My sojourn in Southern Africa was made possible by the generosity of the Royal Physiographical Society, Lund, and the Transatlantic Steamship Company, Gothenburg, which granted me free voyage and transported my car and my collections. The major part of my work was sponsored by grants from the Swedish Natural Science Research Council. To all of these, to the Directors of the herbaria mentioned above and to my lichenological colleagues, who have aided me in many ways, I express my sincere thanks. I want to mention especially Dr. M. E. HALE, Dr. R. SANTESSON and Dr. E. A. SCHELPE, who have critically read my manuscript.

### *Candelaria* Mass.

MASS. Flora 35 : 567. 1852. ZAHLBR. Cat. lich. univ. 6 : 3. 1929, 8 : 551. 1932, 10 : 500. 1940. HILLM. Rabenh. Kryptog. Fl. Deutschl. ed. 2. IX. 5/3 : 19. 1936. LAMB, Index nom. lich. 139. 1963.

Type species: *C. vulgaris* Mass. (syn. of *C. concolor*). Cf. below.

**Thallus** minutely foliose or squamulose, suborbicular or spreading (c. 0.5—2 cm. diam.), closely appressed to ascending, corticate on both surfaces; yellow above (K—, calycin present), pale beneath, with  $\pm$  developed whitish rhizines. Algae bright green (*Trebouxia*).

**Apothecia** sessile, lecanorine. Asci broadly clavate, with 20—50 spores. Spores hyaline, ellipsoidal, 1-celled (or sometimes pseudo-septate). Paraphyses discrete, septate and clavate. Pycnidia not unfrequent, laminal, immersed in yellow or orange-coloured warts, spherical

or pyriform, c. 0.1 mm. diam. Microconidia hyaline, ellipsoidal, c.  $2 \times 0.5 \mu$ .

### 1. *C. concolor* (Dicks.) Stein

STEIN in COHN, Kryptog. Fl. Schles. II. 2:84. July 1879. ARN. Flora 62:364. Aug. 1879. DOIDGE, Bothalia 5:309. 1950.

*Lichen concolor* Dicks. Fasc. Plant. Cryptog. Brit. 3:18. 1793. — Type collection: "Scotland 1786 J. DICKSON" (BM, lectotype).

*Parmelia parietina* var. *laciniosa* Duf. ex E. FRIES, Lich. eur. ref. 73. 1831. — Type collection (as "*Parmelia fibrosa* nob.", scr. E. Fr.): France. St. Seves (?). DUFOUR no. 240 (UPS, lectotype).

*Lecanora laciniosa* (Duf. ex E. Fr.) Nyl. Flora 64:454. 1881. STIZENB. Ber. St. Gall. naturv. Ges. 1888—89, no. 637. 1890.

*Candelaria vulgaris* Mass. Flora 35:568. 1852. — Type collection: FLÖRKE, Deutsche Lich. no. 171 B (UPS, lectotype).

*Candelaria substellata* ("Ach.") Räs. An. soc. cient. Arg. 128:137. 1939, sec. specimina austroameric. in herb. Räs. (H).

[*Lecanora candelaria* var. *substellata* Ach. Syn. meth. lich. 192. 1814 is illegitimate, being a superfluous name for *Lecanora candelaria* var. *substellaris* Ach. Lich. univ. 417. 1810. The type of the latter ("in cortice arborum Silesiae. MOSIG") in herb. ACH. (H) (as "var.  $\gamma$  *substellata*") is *Xanthoria fallax* (Hepp) Arn. Cf. VAINIO, Etude lich. Brésil 1:71. 1890.]

*Candelaria quintanilhae* C. Tav. Revista de biol. 4:138. 1964. — Type collection: Cape Verde Islands. S. Antao, on bark of *Jatropha*, 1958 K. BYSTRÖM (LISU 159, holotype).

Thallus irregularly spreading or growing in small rosettes,  $\pm$  deeply incised; upper surface smooth, dull, chrome-yellow (or greenish yellow to greyish). Lobes c. 1 mm. long, c. 0.1—0.5 (—1) mm. broad,  $\pm$  lacinate, discrete or  $\pm$  imbricate; margin entire or often granulose; soredia developing from marginal granules (rarely also laminar),  $\pm$  abundant, sometimes densely crowded in the central parts, concolorous with the upper surface.

Apothecia not infrequent in South Africa, rounded, c. 0.5—1.5 mm. diam.; disc concave to flat, yellow (or brownish yellow); exciple concolourous, entire or granulose-sorediose, sometimes bearing white fibrils. Spores  $6-15 \times 4-6 \mu$ .

**Variability.** There are very few differences in the range of variation between the South African and European populations. It is difficult to distinguish any subspecific units founded on genotypic characters. The small variation is obviously due to environmental factors.

Forms with extremely broad lobes (up to 1 mm.) have been noticed exceptionally, e.g., in Qachas Nek, Basutoland. This collection evidently

grew in a wet habitat (on bryophytes). It seems to be identical to *C. quintanilhae* C. Tav., recently described from 3 stations in the Cape Verde Islands, according to a specimen kindly placed at my disposal by Dr. TAVARES. There is no distinguishing character quoted other than the broad lobes.

Forms with narrow, discrete, radiant lobes are much more frequent and form every intergrade with the main type. These forms correspond well with the South American plants recorded by RÄSÄNEN as *C. substellata* ("Ach.") Räs.

Forms growing on substrates subject to high impregnation with dust have their marginal lobes reduced to scattered squamules, and the centre forms a  $\pm$  continuous granulose — sorediose crust ["var. *effusa* (Tuck.) Merr. et Burnh.", more or less identical with "f. *citrina* (Krempeh.) Arn." and "f. *granulosa* (Harm.) Boist."]. They seem to be less frequent in South Africa than in many parts of Europe and N. America. The colour of the upper surface is rarely greyish or greyish yellow (often only part of an individual). Such shade forms ("f. *chlorina* Harm.") are rare in our material.

An aberrant colour of the apothecia seems to be more than a modification: f. *phaeocarpa* n.f. Discus apotheciorum rufofuscus vel obscurus fuscus. — Disc reddish brown to dark brown.

**Angola.** Prov. Biè, Chinguar, avenue in the village, on *Jacaranda*, common. 1960 G. DEGELIUS (Herb. DEGEL., holotype; LD, isotype). The rich material contains apothecia in all stages of development, all with brown discs without any tinge of yellow. — The same form is also observed from **Brazil.** Prov. Matto Grosso, Santa Anna da Chapada, on bark, 1894 MALME 2397 (S). Cf. MALME 1937 p. 34 (without any comments on the colour).

**Excluded Species.** DOIDGE recorded two other species, viz. *C. fibrosa* and *C. stellata*. The latter has proved to be synonymous with the former. The true *C. fibrosa* is a good species, but the S. African records belong to *C. concolor*.

#### ***C. fibrosa* (Fr.) Müll. Arg.**

MÜLL. ARG. Flora 72: 319. 1887.

*Parmelia fibrosa* Fr. Syst. orb. veg. 284. 1825. — Type collection: "America septentrionalis" (UPS, lectotype).

*Physcia fibrosa* (Fr.) Nyl. Syn. lich. 1: 413. 1860.

*Lecanora laciniola* ssp. *fibrosa* (Fr.) Stizenb. Ber. St. Gall. naturv. Ges. 1888—89, no. 638. 1890.

*Parmelia fibrosa* var. *stellata* Tuck. in DARLINGTON, Flora cestricea, ed. 3: 440. 1853. — Type collection: U.S.A. New Hampshire, "in *Pyro Malo*; vulgaris

in Pomario Crawfordiano. Sept. 1848. E. T(UCKERMAN)" (FH, lectotype, as "*P(hyscia) candelaria* var. *stellata* Tuck.")

*Physcia candelaria* var. *stellata* (Tuck.) Nyl. Enum. gén. lich. 106 (1857) 1858. TUCK. Proceed. Am. Acad. 4: 388. 1860. (Citations in ZAHLBR. Cat. lich. 6: 9. 1930 are misleading.)

*Candelaria stellata* (Tuck.) Müll. Arg. Flora 72: 319. 1887. LYNGE, Nyt Mag. Naturv. 62: 95. 1924.

Lobes appressed,  $\pm$  imbricate, as a rule broader than in *C. concolor* and not so deeply incised, sometimes narrow and stellate, convex, somewhat incurved or slightly crenulate, lacking soredia. Apothecia numerous, constricted at the base, bearing  $\pm$  numerous white fibrils below, disc  $\pm$  brownish yellow, often pruinose, exciple entire or  $\pm$  crenulate, sometimes fibrillose. Otherwise as in *C. concolor*.

MÜLLER ARG. and HUE distinguished between two non-sorediate species, *C. fibrosa* (lobes c. 2—3 mm. broad) and *C. stellata* (lobes narrow, elongate, c. 0.2—0.5 mm.). The brief report by MÜLLER and the very detailed descriptions by HUE give no other distinguishing characters. I have been able to examine TUCKERMAN's material preserved at the Farlow Herbarium in Cambridge, Mass. It consists of 14 samples in the same envelope. According to the Rules of Nomenclature. Art. 9, the whole set can be considered as the lectotype. This rich material shows all transitions between the "normal" broad-lobed *fibrosa* type and the narrow-lobed *stellata* type. Two copies of TUCKERMAN's exsiccata Lich. Amer. sept. no. 88 (as *Parmelia fibrosa* Fr.) in BM and UPS exhibit the same variation. As in *C. concolor*, therefore, lobe width seems to be of no taxonomic importance.

*C. fibrosa* (s. lat.) is distributed in various parts of N. and S. America and in E. Asia (China and Japan). It often grows together with *C. concolor* and was considered a synonym of it by TUCKERMAN in his later years (1882 p. 51). *C. fibrosa* is well separated in having more appressed lobes and principally in the lack of soredia. The white fibrils under the apothecia, often quoted as a diagnostic character, are sometimes found also in *C. concolor*. In U.S.A. the two species often grow intermixed, one sometimes growing over the other, but without any transitional stages. *C. fibrosa* and *C. concolor* constitute an analogy to other pairs of species, one non-sorediate and fertile, the other sorediate (or isidiate) and as a rule sterile; e.g., *Xanthoria elegans* and *X. sorediata*, *Physcia pulverulenta* and *Ph. grisea*. Cf. further my paper on *Xanthoria africana* (ALMBORN 1963 p. 166) and literature quoted there.

Some fertile, fibrillose specimens from southern Africa have been quoted as *C. fibrosa* (cf. list of localities below). Since they are sorediate,

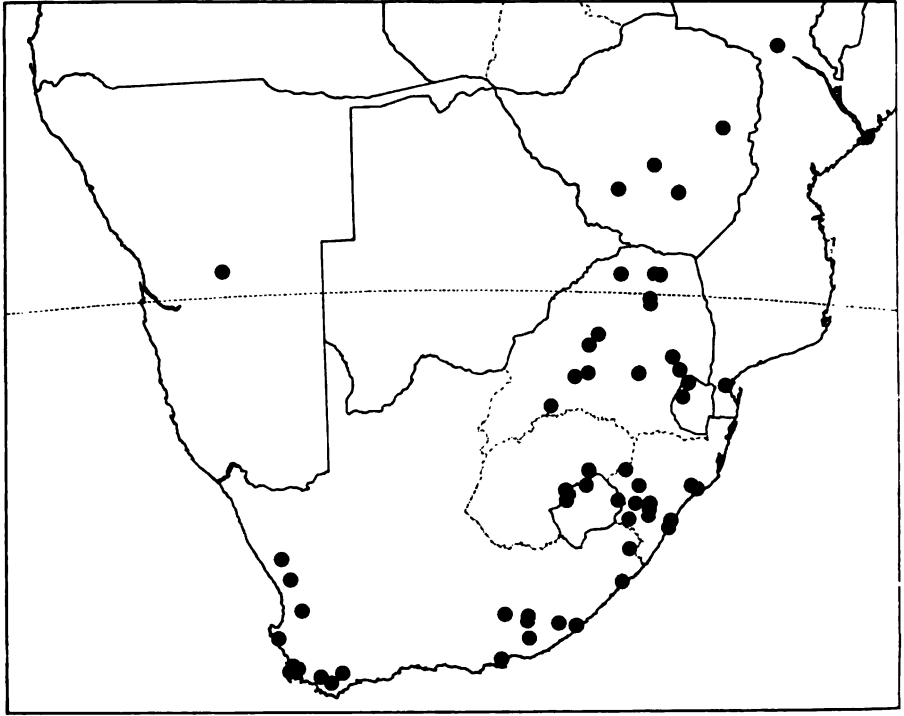


Fig. 16. *Candelaria concolor* (Dicks.) Stein. World-wide distribution, mainly in temperate districts.

they should be identified as *C. concolor*. Some specimens in the S. African material (especially from Polela Forest in Natal and the Zoutpansberg and Pietersburg divisions in Transvaal) have scattered granules but lack really developed soredia. I have been in doubt as to their identity, but Dr. R. SANTESSON has shown me similar specimens from S. America, e.g., Chile, Prov. Santiago, San José, on shrubs in mountain slope, 1940 SANTESSON 2433 (S) and Argentina, Prov. Santa Cruz, Rio Gallegos, Estancia Güer-Aike, on basaltic rocks, 1940 SANTESSON 7087 (S). This material contains all transitions to typical sorediate *C. concolor*.

**Ecology.** On trunks of trees, mainly in parks, gardens and along roadsides, rarely on rocks. A coniphilous species, favoured by the influence of dust containing nitrogen and phosphorus compounds.

**Distribution.** Fairly frequent, at least in the wooded districts, though often in small quantities, rare in the almost treeless arid areas.

## Cape Province

Namaqualand. 10 miles N.W. of Garies, on twigs of *Acacia*, ALMBORN 4716 (LD) ( $\pm$  pulvinate). — Sine loco exacto, on twigs of a shrub, MARLOTH 6405 (PRE, W as "*Xanthoria fibrosa*"). ZAHLEBRUCKNER 1926 p. 547, DOIDGE 1950 p. 366 (all as *Xanthoria candelaria* f. *fibrillosa*). — Van Rhynsdorp. 2 miles N. of Nieuwe Rust, rocks near road, ALMBORN 4896 a (LD). — Clanwilliam. C., on *Vitis* in an orchard, ALMBORN 4504 a (LD). — Hopefield. Saldanha, near Danger Bay, on twigs, F. M. LEIGHTON (BOL with *Teloschistes capensis* no. 1724). — Bellville. Durbanville, on *Schinus molle*, v. D. BYL 422 (STE, TUR), det. VAIN., v. D. BYL 1931 p. 13. DOIDGE 1950 p. 309. — Cape. Cape Town, between Kloofnek and the Round House, on *Quercus*, ALMBORN 914 (LD) (greyish, fibrillose). — Kirstenbosch Botanical Gardens, on *Acacia*, ALMBORN 1605 (LD) ( $\pm$  pulvinate, fibrillose). — Ibid., Window Gorge, on branches of a shrub, ALMBORN 1116 (LD). — Ibid., Skeleton Gorge, on *Brabeium* near stream, ALMBORN (LD with *Physcia erosula* no. 228). — Southern Cross Estate, on *Quercus* by the road, ALMBORN 1521, 1522 (LD) (fibrillose). — Stellenbosch. S., sine loco exacto, DUTHIE 9 (STE). DOIDGE l.c. — S., on *Salix*, GARSIDE 93 (BM). v. D. BYL l.c. — Eerste River, on *Quercus*, GARSIDE L. 68 (BM) (both fibrillose). — Caledon. 10 miles E. of C., on *Quercus* by main road, ALMBORN 2036 (LD) ( $\pm$  pulvinate). — Bredasdorp. Napier, on bark, H. SWART (BOL with *Teloschistes chrysophthalmus*). — Swellendam. On shrubs in a garden in the N. part of Sw., ALMBORN 2125—27, 2172 (LD) (fibrillose). — Port Elizabeth. Near Coega, on twigs of shrubs, ALMBORN 4082—84, 4093 (LD). — Ibid., on trunks of *Euphorbia*, ALMBORN 4111 (LD) (both  $\pm$  pulvinate). — Somerset East. Boschberg, on bark, MACOWAN 502 [BM as *Physcia fibrosa*, SAM as "*Physcia candelaria (fibrosa)*"]. STIRTON 1877 p. 215 (as *Ph. fibrosa*). STIZENBERGER 1890 no. 637 (as *Lecanora laciniosa*). DOIDGE l.c. — Albany. Grahamstown. Rhodes College, near Milne House, on *Jacaranda*, ALMBORN 10858 (LD) ( $\pm$  pulvinate, fibrillose). — Fort Beaufort. F.B., on twigs, SCHAEFER (PRE with *Physcia* sp. no. 2075). — Stockenström. On hill W. of Tidbury's Toll, on twigs of *Lycium* and *Rhus*, F. A. S. TURNER (PRE 1862). — Kingwilliams-town. K., on bark, H. A. WAGER (BM). — East London. E. L., on trees in Queen's Park, ALMBORN 10652 (LD). — 13 miles E. of E. L., near road to Potsdam, on *Acacia*, ALMBORN 10674 (LD) ( $\pm$  pulvinate). — Port St. Johns. 5 miles N.W. of P.St.J., on *Pinus* near road, ALMBORN 10557—59 (LD) ( $\pm$  pulvinate, fibrillose).

## Natal

Alfred. Ingele Forest, on rocks, ALMBORN (LD with *Teloschistes exilis* no. 10334). — Polela. Polela Forest, on bark, ALMBORN 9422, 9564 (LD) (narrow-lobed, fibrillose, scarcely sorediate). — Durban. D., on *Hyphaene crinita*, HÖEG (TRH with *Anaptychia* sp.). — Botanical Garden, on bark, ALMBORN 8540 (LD) ( $\pm$  pulvinate). — Isipingo Rocks, on bark, ALMBORN 9730—31 (LD) ( $\pm$  pulvinate). — Berea, on bark, v. D. BYL 18 (BM). — Lions River. Boschfontein Forest, on bark, ALMBORN 8669 (LD). — Pietermaritzburg. Chatterton Road near P.M.B., on *Quercus*, HÖEG (TRH with *Physcia* sp.). — Natal Table Mt., lower slopes, on bark, ALMBORN 8558 (LD). — Camperdown. C., on *Syringa*, HÖEG (TRH with *Parmelia* and *Anaptychia* spp.). — New Hanover. Appelsbosch, on bark, FR. LJUNGQVIST (UPS). — Weenen. W., Town Land, on twigs, H. P. THOMASSET. Comm.

HÖEG (TRH with *Physcia* sp.). — Eshowe. E., near post-office, on *Jacaranda*, ALMBORN 8483 (LD). — Along Inyezane River between Mtumzemi road and Inyezane Siding, on isolated *Erythrina* trees, HÖEG (TRH with *Physcia* sp.). — Klip River. Brakval Station, on *Pinus*, HÖEG (TRH with *Physcia* sp.).

#### Orange Free State

Ladybrand. L., on sandstone rock, MAAS GEESTERANUS 11970 (L with *Parmelia* sp.). — Bethlehem. Clarens, on bark of *Prunus persica*, v. D. BLANK (PRE 1914) (p.p. narrow-lobed, fibrillose). — Ibid., on rocks, v. D. BLANK (PRE 1911).

#### Basutoland

Maseru. Near Masite Mt., alt. 1700—2000 m., on bark, J. HEWITT (TRH). — Maphotong Valley, on sandstone, KOFLER (LD). — Near Caledon River, on bark, KOFLER (LD). — St. Michael, on mossy rock, KOFLER (LD). — Qachas Nek. Black Mts. between Mokhotlong and Sani Pass, alt. c. 3200 m., among mosses on basalt rock, KOFLER (LD) (broad-lobed). — Leribe. Buthabuthe, on *Eucalyptus*, KOFLER (LD).

#### Transvaal

Potchefstroom. P., on *Thuya*, KOFLER (LD). — Krugersdorp. Magaliesberg, N. slopes near Klein Wonderboom, on *Croton*, MOGG (PRE with *Physcia* sp. no. 1981). — Pretoria. P., on *Jacaranda*, KOFLER (LD with *Physcia* sp.). — Zoological Garden, on bark, ALMBORN 5883 (LD). — Hartbeest Dam, near the hotel, on bark, HÖEG (TRH). — Fountains Valley, on *Acacia karroo*, DOIDGE (PRE with *Physcia* sp. no. 1760). — Meintjes Kop, on *Acacia caffra*, MOGG (PRE with *Physcia* sp. no. 1837). — Waterberg. Two miles N. of Warmbad, on bark, ALMBORN 5902—07 (LD). — Krantzkop, near Nylstrom, on trees in bush, KOFLER (LD). — Middelburg. Olifants Rivier, on bark, E. SCOTT (PRE with *Pyxine* sp. no. 1825). — Lydenburg. Spitzkop near L., on bark, WILMS (ZT). STIZENBERGER 1890 no. 637. DOIDGE p. 309 (all as *Physcia* or *Candelaria fibrosa*). — Nelspruit. N., on bark, SCHAEFER (PRE 1927). — Pietersburg. Woodbush, Kaaimansgat Forest, on twigs, MOGG (PRE with *Physcia* sp. no. 1981). — Blaauwberg, rocky S. slopes, alt. 1800 m., on twigs, ESTERHUYSEN 21549 a (LD with *Teloschistes exilis*) (granular, few soredia; ap. brownish yellow). — Letaba. Between Munnik and Tzaneen, on bark, E. SCOTT (PRE with *Pyxine* sp.). — Zoutpansberg. Piesanghoek, on *Citrus limonum*, P. WATSON (PRE 774). DOIDGE l.c. (as *C. fibrosa*) (fibrillose, granular, few soredia). — Louis Trichardt, S. slope, on twigs, KOFLER (LD). — Near Punch Bowl Inn, N. of Louis Trichardt, on rocks and on bark and twigs of cultivated trees, ALMBORN 6207, 6297, 6455, 6456, 6614 (LD) (p.p. fibrillose, granular, few soredia). — Between Overwinning and Wyllies Poort, on bark, ALMBORN 6404 (LD). — Hanglip Forest near Louis Trichardt, on rocks, alt. 1500 m., ALMBORN 6637 (LD).

#### Swaziland

Mbabane. M., Swazi Inn, on bark, KOFLER (LD). — Peak. Piggs Peak, near police station, on *Jacaranda*, ALMBORN 7900 (LD).

**Moçambique**

Sul do Save. Lourenço Marques, on bark, ALMBORN 7183—87 (LD). — Ibid., near Hotel Clubo, on base of cultivated trees, ALMBORN 6876 (LD). — Tete. Boroma, on bark, MENYHARTH 262, 264 (WU). MÜLLER ARG. 1893 p. 296. STIZENBERGER 1895 p. 22 (under no. 638 *Lecanora laciniosa* \**L. fibrosa*). DOIDGE l.c. (as *C. fibrosa* and *C. stellata*).

**Rhodesia**

Bulawayo. Near B., on trees in the bushfield near Mr. MENNELL's farm, HÖEG (TRH with *Physcia* sp.). — Victoria. Zimbabwe, on the stem of a big *Acacia*, HÖEG (TRH, fragment with *Physcia* sp.). — Ibid., on trees in the ruins, HÖEG (TRH with *Parmelia* sp.). — Gwelo. G., on *Acacia* along road, HÖEG (TRH with *Physcia* sp.). — Makoni. Sine loco exacto, on bark, alt. 1600 m., EYLES 824 (BM, K, PRE no. 211).

**S.W. Africa**

Windhoek. Wasserberg (near Windhoek), on bark, FINCKE (W 341).

**Angola**

Huila. Humpata Plateau, above Sá-da-Bandeira, *Brachystegia* forest, alt. c. 1900 m. DEGELIUS (DEG., LD). — Bié. Chingüar. DEGELIUS (f. *phaeocarpa*; see above). — Bengüela. C. 50 km. S. of town, dense bush (*Acacia* etc.) near road, on shrub, DEGELIUS (DEG.) (p.p. granular). — Cuanza Sul. Faz. Chiipepe (near Cassongue), on *Cupressus*, alt. c. 1800 m., DEGELIUS (DEG.). — Quanza Norte. Golungo Alto, "ad truncis in sylvis prope Sange, WELWITSCH 153. — Pungo Andongo," ad *Velloxias* in rupibus prope Praesidium, WELWITSCH 111. Both sec. VAINIO 1901 p. 402. N. B. The Angola stations are located N. of the area covered by the map (fig. 16).

***Solorina* Ach.**

ACH. K. Vet. Akad. Nya Handl. 1808: 288. Id. Lich. univ. 27 et 149. 1810. HUE Monogr. gen. *Solorinae* (in Mém. Soc. Sci. Nat. Cherbourg 38: 1). 1911. ZÄHLBR. Nat. Pfl. Fam. 8. Lichenes 188. 1926. Id. Cat. lich. univ. 3: 408. 1925, 8: 313. 1932, 10: 279. 1939. LAMB. Index nom. lich. 662. 1963. — Type species: *S. crocea* (L.) Ach. FINK, Lich. Minnes. (in Contrib. U.S. Nat. Herb. 14(1) 158. 1910).

*Solorina* Nyl. Le Naturaliste 6: 387 (repr. 2). 1884. Id. Flora 67: 219. 1884. Type species: *S. simensis* (Flot.) Nyl.

Thallus foliose or squamose, orbicular, irregularly lobed, rather loosely attached to the substratum, heteromerous; upper surface grey or brown, smooth, corticate; under surface pale brown or whitish (in *S. crocea* deep orange or brick red), ecorticate, naked or bearing long scattered whitish rhizines. Algae forming a thin layer immediately under the upper cortex, green (*Parmellaceae*) or blue-green (*Nostoc*), often



both types together, the latter ("internal cephalodia") sometimes predominating over the former. Cf. further MOREAU 1921 p. 81, OZENDA 1963 p. 118.

Apothecia laminal, adnate or often immersed; disc roundish, concave, reddish brown or dark brown. Asci cylindrical, containing 1—8 spores. Spores oblong or ellipsoid, 2-celled, pale to dark brown, often constricted at the septum, episporium often granular. Paraphyses unbranched, septate. Pycnidia unknown.

### 1. *S. saccata* (L.) Ach.

ACH. ll. cc. HUE l.c. 21 (descr. ampl.).

*Lichen saccatus* L. Fl. Suec. ed. 2.419. 1755. Id. Sp. Pl. ed. 2.1616. 1763. — Type collection: Norway, "in alpinibus<sup>3</sup> norvegicis". T. HOLM (LINN, specimen no. 1273: 197, lectotype).

*Peltigera saccata* var. *pruinosa* Del Amo, Fl. Crypt. Penins. Ibér. 368. 1870. — Type collection: Spain (not located).

*Solorina saccata* var. *pruinosa* (Del Amo) Gyelnik, Lilloa 3: 60. 1938.

*Solorina simensis* Hochst. ex Flot. Linnaea 17: 17. 1843. NYL. Synopsis Lich. 1: 330. 1860. HUE l.c. 12. — Type collection: Ethiopia, Simien Prov., "ad rupes umbrosas montis Bachit prope Demerki". 1838 W. SCHIMPER. SCHIMPER, Iter Abyss. (exs.) no. 445 (K, lectotype; isotype in UPS).

*Solorinina simensis* (Flot.) Nyl. l.c.

Thallus c. 2—4 (—6) cm. diam.; lobes c. 0.5—1 mm. broad, rounded, slightly crenate or incised; upper surface brownish grey to ash-grey (green when moist), sometimes minutely areolate-scabrid and whitish pruinose; under surface  $\pm$  indistinctly veined, reddish brown to whitish, with long scattered rhizines.

Apothecia scattered, rounded, c. 1—2 (—5) mm. diam., concave and  $\pm$  deeply sunk, rarely plane or somewhat convex, dark brown to reddish brown, epruinose; exciple concolourous with the thallus, soon disappearing. Spores 4 in the ascus, in the S. African material c.  $28\text{--}43 \times 14\text{--}19 \mu$ ; otherwise up to  $60 \times 24 \mu$ .

**Variability.** The South African material shows a certain variation as to the colour and pruinosity of the thallus surface and the shape of the apothecia. The colour varies from greyish to brownish, often slightly pruinose. The rich material from Mohales Hoek distributed in my exsicc. no. 55 has a thick pruinose cover that imparts a whitish tinge to the thalli. It is evident that in *S. saccata*, as in many other lichen

<sup>3</sup> Not "rupibus", as quoted by SAVAGE, Cat. Linn. Herb. 198. 1945.

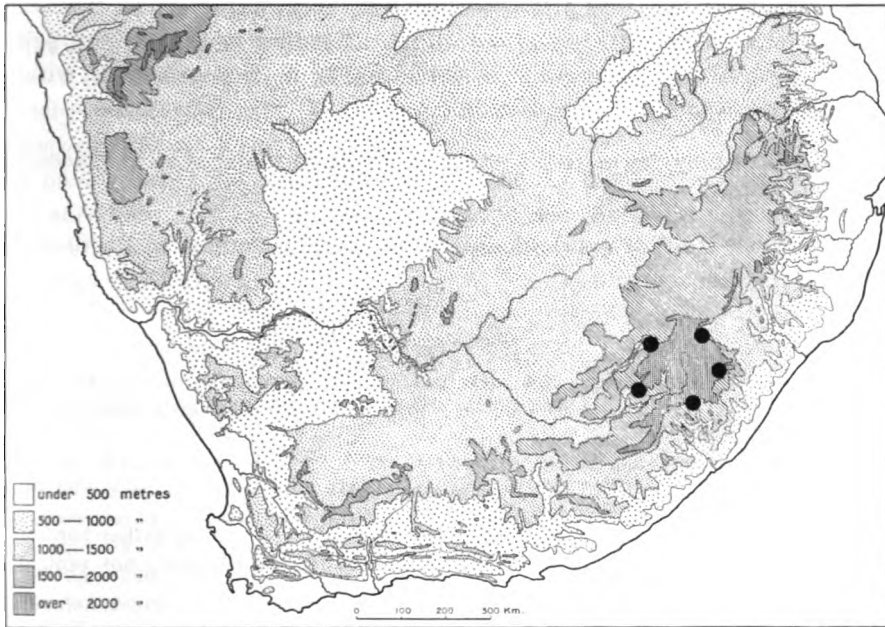


Fig. 17. *Solorina saccata* (L.) Ach. Worldwide distribution, mainly in high mountains and in calcareous districts.

species, pruinosity is a response to environmental factors and should not be used as a taxonomic criterion. I agree with WEBER (1962 p. 318) in his thorough discussion of this problem. Cf. also ALMBORN 1963 p. 167.

Most of the specimens have plane (to slightly convex) apothecia. In this respect they agree well with the lichen known as *S. simensis* Flot. The material from from Mohales Hoek mentioned above, however, has wide variation in the shape of the apothecia, from deeply saccate (=the main type of the species) to plane. An examination of much material of *S. saccata* from various parts of the world shows that the apothecia can occasionally be more or less plane. NYLANDER (1860) stated *S. simensis* to be "arcte affinis *S. saccatae*" but differing in having a somewhat more distinctly veined under surface and plane or slightly impressed apothecia. Later (1884) he reported it as having bluish "gonimia". For this reason he created a new genus, *Solorinina* Nyl., including *S. simensis*, *S. crocoides* NYL. (now included in *S. crocea*) and, with doubt, *S. sorediifera* (Nyl.) Nyl. (cf. below). The

subdivisions of *Solorina* proposed by HUE (l.c.) characterized by different algal components, have no validity according to the present principles of lichen taxonomy. It is evident that *S. simensis* falls within the range of variation of *S. saccata*.

**Ecology.** In crevices of rocks or on bare soil, in moist shaded places, at high elevation.

**Distribution.** Rare or overlooked, known from 5 stations in Basutoland and the Drakensberg area.

#### Cape Province

**Matatiele.** S. of Qachas Nek, near boundary to Basutoland, among shrubs of *Leucosidea*, near road, alt. c. 1700 m., KOFLER (LD) (brownish grey, slightly pruinose, ap. plane).

#### Natal

**Bergville.** Drakensberg, Mt. Weni area, on mossy faces or on rather bare soil, alt. 2700—3000 m., ESTERHUYSEN 21604 (BOL, LD) (brownish grey, not pruinose, ap. plane to convex).

#### Basutoland

**Mohales Hoek.** Near Mphrane (10 miles N.E. of M.H.), on vertical rocky bank of a stream, on soil, alt. c. 2500 m., KOFLER 31131. ALMBORN, Lich. afr. 55 (LD etc.) (whitish grey, pruinose, ap. plane to concave). — **Maseru.** Maluti Range, near Blue Mountain Pass, alt. c. 3000 m., KOFLER 36218 (LD) (brownish, slightly pruinose, ap. plane to concave). — **Qachas Nek.** Q.N., Sani Pass, alt. 2700 m., KOFLER 31115 (LD) (brownish grey, slightly pruinose, ap. plane).

#### Excluded Species.

##### *Solorina soledifera* Nyl.

NYL. Synopsis lich. I: 331. 1860. HUE, Monogr. gen. *Solorinae* (in Mém. Soc. Sci. Nat. 38: 15). 1911. DOIDGE 263. 1950. — Type collection: "Cap. B. Spei. Herb. Sonder" (H: herb. Nyl. no. 32915, lectotype; isotype in PC, sec. HUE l.c., cf. below).

"Thallus lurido-pallescent vel subcervinus rotundato-lobatus, ambitu undulatus, fere mediocris (latit. circa 1-pollicaris) soledii caesio-viridibus discoideis adpersus, subtus pallidus, nervis indeterminatis crassiusculis fuscis et ambitum versus rufescentibus vel pallidis vellereis.

Ad Promontorium Bonae Spei.

Apothecia non visa, sed omnino hujus generis videtur. Affinis sit *Simensi*, at nervis paginae inferae thalli aliis, nec rhizinae nullae elongatae visae." (NYLANDER l.c.).

The type material (without an exact locality) is the only collection of this lichen. GYELNIK (1932 p. 43) studied the type in the Paris herba-

rium and stated that it is identical with *Peltigera leptoderma* Nyl. In my opinion, "*P. leptoderma*" falls within the range of variation of *P. spuria* (Ach.) DC. The sorediate stages of this species, which intergrade completely with "typical" *P. spuria*, have sometimes been called *P. erumpens* (Tayl.) Vain.

I have studied the type material in Helsinki (herb. NYL.). It is sterile and sorediate and has no resemblance to any *Solorina* species. It belongs without doubt to *P. spuria*, a species now known from several localities in S. Africa.

## *Placopsis* (Nyl.) Lindsay

LINDSAY, Transact. Linn. Soc. Lond. 25: 536. 1866. LAMB, Lilloa 13: 151. 1947. Id. Index nom. lich. 577. 1963.

*Lecanora* subgen. *Placopsis* Nyl. Journ. Linn. Soc. Bot. 9: 251 (footnote). 1866.

*Placodium* sect. *Placopsis* Müll. Arg. Bot. Jahrb. 5: 135. 1884.

*Lecanora* sect. *Placopsis* (Müll. Arg.) Zahlbr. Nat. Pfl. Fam. 1: 1. Lichenes. 202. 1907 et ibid. ed. 2. 8. Lichenes 225. 1926. Id. Cat. lich. univ. 5: 664. 1928, 8: 547. 1932, 10: 492, 1940.

Dr. R. SANTESSON has drawn my attention to the fact that the usual citation "*Placopsis* Nyl. Ann. Sci. Nat. Bot. sér. 4(15): 376. 1861" is incorrect. NYLANDER never accepted *Placopsis* as a genus. L.c., he incidentally wrote "*Placopsis gelida*", but the species was listed as *Squamaria gelida* (L.) Hook. Under *Squamaria rhodocarpa* Nyl. he introduced "subgenus idem, cui nomen *Placopsis* proposui" (with a short description), but he did not clearly indicate the position of the subgenus (under *Lecanora*?). As he also (l.c.) treated the same two species as "forsan melius sicut sectionem peculiarem generis *Lecanorae*...", these subdivisions cannot be considered as accepted by NYLANDER in 1861.

Type species: *P. gelida* (L.) Lindsay sec. LAMB 1947 p. 180.

Thallus  $\pm$  distinctly lobate to effigurate at the circumference, crustaceous in the centre, usually greyish, in some species isidiate (not in the S. African species) or sorediate. Algae green ("*Pleurococcus*"); upper surface bearing cephalodia containing blue-green algae.

Apothecia usually present in most species, immersed (aspiciloid) to sessile (lecanorine). Asci cylindrical, containing 8 spores. Spores uniseriate, simple, hyaline.

### 1. *Placopsis gelida* (L.) Lindsay

LINDSAY l.c. 1866. LAMB, Lilloa 13: 190. 1947 (descr. ampl.).

*Lichen gelidus* L. Mantissa plant. 133. 1767. — Type collection: Iceland.

J. G. KÖNIG (holotype lost). LINNAEUS (l.c.) quoted DILLENIUS, Hist. musc. tab. 18, fig. 18 a, c. 1741, which, however, refers to *Caloplaca murorum* (Hoffm.) Th. Fr. (or a related species), sec. CROMBIE, Journ. Linn. Soc. Bot. 17: 565. 1880 (as

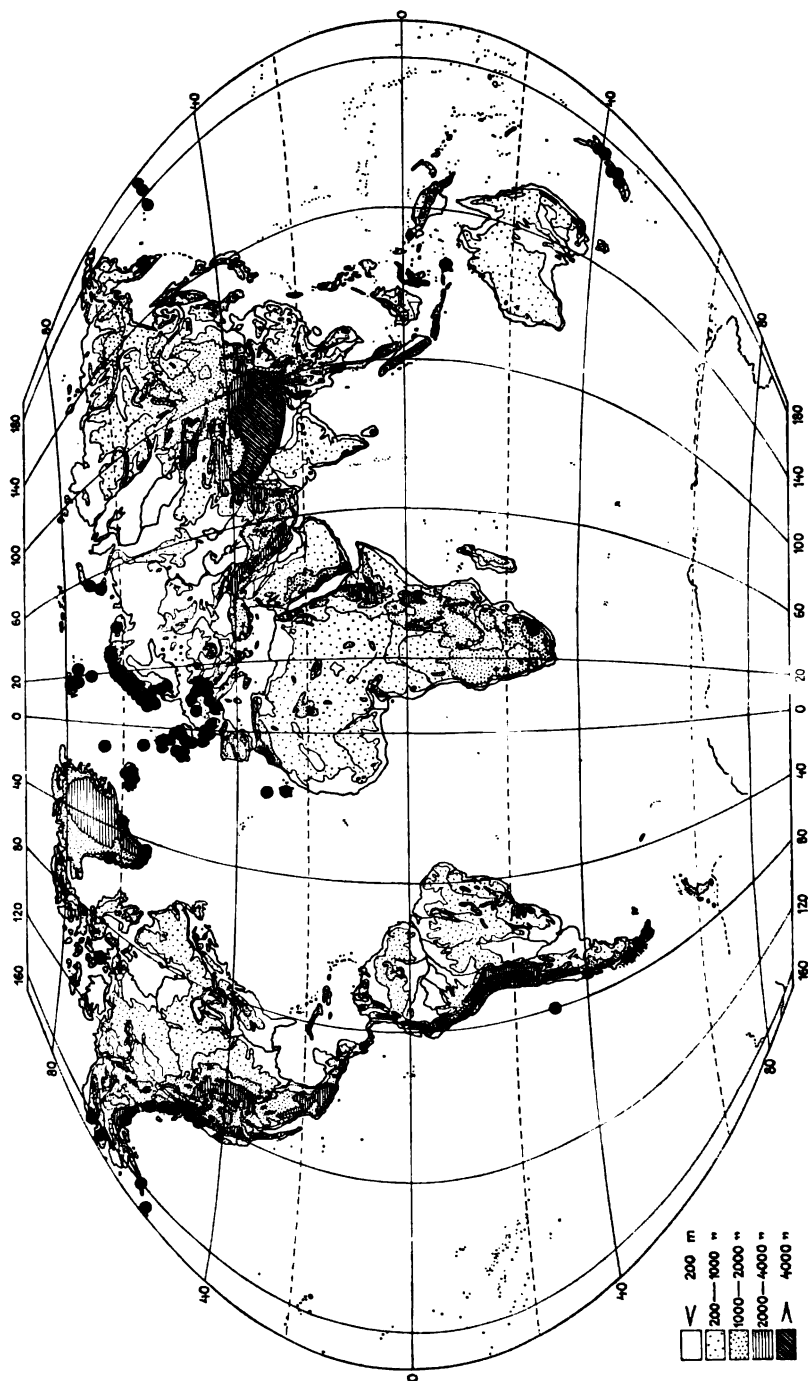


Fig. 18. *Placopsis gelida* (L.) Lindsay. Total distribution known. Data from LAMB 1947 p. 190 with the addition of the S. African station.

"*Placodium murorum*"). Neotype (LAMB l.c. p. 202): Iceland, Arnes, Reykir 1937, leg. LYNGE (O).

*Lecanora gelida* (L.) Ach. Lich. univ. 428. 1810. ZAHLBR. Cat. lich. univ. II. cc.

Thallus orbicular, c. 2 cm. diam.,  $\pm$  confluent, closely adpressed to the substratum; marginal lobes contiguous, subdichotomously branched, c. 2 (—5) mm. long, c. 1 mm. broad; central part rimose to areolate; upper surface smooth, dull, (dirty brownish) grey, not pruinose; soredia scattered over the centre, rounded to irregular, c. 0.5—1 mm. diam., not elevated, dark greenish; cephalodia scattered over the centre, orbicular, c. 1—2 mm. diam., plicate, cracked or granular, brownish to flesh-coloured.

Reactions. Cortex K + yellowish, C + rose-red, Pd —. Medulla K —, C + rose-red, Pd —.

Apothecia absent in the S. African material.

This brief description is based only on the S. African specimens. For further details as to morphology and synonymy, I refer to the detailed monographic treatise by LAMB (l.c.).

Variability. The scarce material present from our area seems to be fairly uniform. The specimens are sterile and somewhat depauperate, but otherwise they agree well with the "main type" of the species, as represented in the Scandinavian high mountains.

Ecology. On wet rocks, at high altitude. Cf. below.

Distribution. Known from one station:

#### Basutoland

Leribe: Oxbow, valley E. of the camp, on basaltic rock near a stream, alt. c. 3000 m., KOFLER 311 291 (LD). Confirm. LAMB.

LAMB (l.c.) accepted 31 species of *Placopsis*, most of them with fairly restricted areas. 11 species are known from the southern parts of S. America only, 9 species from the Australia — New Zealand area only, and 4 species from both of these main centres. The distribution of the genus has a marked preponderance in the southern hemisphere. No species has hitherto been recorded in literature from the African continent. Collections from the Canary Islands and Madeira are somewhat doubtful (sec. LAMB). There may be a distinct variety or species in Macaronesia. Sec. LAMB (in litt.) there is an unpublished record of *P. parellina* (Nyl.) Lamb from Kenya, Mt. Kenya, on soil in *Podocarpus*-forest, alt. c. 3300 m.

*P. gelida* is the only species in this genus with a wide distribution also in the northern hemisphere (fig. 18). In this area it has a clear oceanic tendency, but it is decidedly more arctic — circumpolar than the lichens treated by DEGELIUS (1935). It has reached optimal ecological conditions in colder temperate and arctic regions, as well in the Scandinavian and British high mountains as near sea level. It is evident that the essential factor in its ecology is constant and high humidity.

The scattered stations known from the southern hemisphere (Java, New Zealand, S. Chile, and (with doubt) Juan Fernandez Islands demonstrate a bipolar type of distribution, which has several analogies among phanerogams and bryophytes. Concerning the many theories dealing with this phytogeographical element and its presumed history (hypothetical migrations, trans-antarctic land connections, etc.), I refer to the detailed discussion in DU RIETZ (1940 p. 215).

The addition of an African station to the area of *P. gelida* has considerable phytogeographical interest.

### Summary

The present paper is an introduction to a series of revisions of lichen genera occurring in Southern Africa. The scope of this work is to complete a Lichen Flora of Southern Africa (up to the 15th parallel). This proposed flora will be founded on the author's own collections from 1953 (c. 12000 nos.) and a large amount of material from African and European herbaria (altogether c. 30000 nos.).

A survey is given of the author's itinerary in 1953 and of the present state of the lichenological exploration of S. Africa.

The outlines of a phytogeography of the S. African lichens are discussed briefly. We can roughly distinguish 6 groups: 1. ubiquitous species, 2. steppe and desert species, 3. high mountain species, 4. oceanic species, 5. tropical-oceanic species, 6. maritime species. The endemic lichens are few. The lichen flora has hardly any correspondence to the rich endemic "Cape Flora" known in the phanerogams. On the other hand, the S. African lichens show interesting connections with other floras, especially S. America.

*Candelaria concolor* has a wide distribution in most wooded districts of S. Africa, whereas *C. fibrosa* and *C. stellata*, which are synonyms, should be excluded from the S. African lichen flora. *C. concolor* f. *phaeocarpa* Almb. is described as new.

*Solorina saccata* (incl. *S. simensis*), now known from 5 stations at high altitudes in the Drakensberg area, is an interesting addition to the S. African lichen flora. The only *Solorina* species previously recorded from S. Africa, viz. the "endemic" *S. sorediifera*, should be excluded. The type material belongs to *Peltigera spuria*.

*Placopsis gelida* is reported, as new to the African continent, from one sta-

tion in the Drakensberg area. The total range of this bipolar species (otherwise known mainly from New Zealand, Java and Chile in the southern hemisphere) is discussed.

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## Från Lunds Botaniska Förenings förhandlingar 1965

**5 februari.** Professor J. A. NANNFELDT höll föredrag om »Svamparna som fanerogamssystematiker». Föredragshållaren gav ett flertal intressanta exempel på hur svampangrepp kan ge upplysningar om värdväxtens fysiologiska, biokemiska och taxonomiska särart. Sammanfattande framhöll föredragshållaren, att svamparna i sitt umgänge med värdväxter i regel visat sig ha samma uppfattning om släktskap som vetenskapsmännen i systematisk botanik.

**8 mars.** Professor HENNING WEIMARCK gav en översikt av florainventeringens framskridande i Skåne.

Docent HANS RUNEMARK talade om *Agropyron pungens*.

Fil. lic. FOLKE ANDERSSON höll föredrag om »Flora och vegetation i Linnebjerg». Domänreservatet Linnebjerg presenterades, och vissa av de ekologiska undersökningar, som utförts inom området, berördes.

Fil. mag. GÖRAN SVENSSON höll föredrag om »Store Mosse och Kävsjön». Vegetationen på Store Mosse behandlades översiktligt, varefter föredragshållaren redogjorde för sina studier av Kävsjöns och dess närmaste omgivningars vegetationsutveckling under de senaste åren.

**26 mars.** Dr PER WENDELBO höll föredrag om »Inntryck fra en botanisk insamlingsreise i Afghanistan i 1962».

Inledningsvis berördes Afghanistans botaniska upptäckthistoria, och föredragshållaren skildrade därefter landets flora och vegetation, som belystes med detaljer från de företagna expeditionsturerna.

**26 april.** Revisionsberättelse avseende 1964 års räkenskaper framlades. Den av revisorerna i anslutning härtill föreslagna ansvarsfriheten beviljades.

Fil. lic. SVEN ASKER höll föredrag över »Cytogenetiska studier inom *Potentilla*». Föredraget handlade huvudsakligen om de arter och artgrupper inom släktet, där apomixis förekommer. Föredragshållarens egna studier avsåg att belysa genetiska skillnader mellan de sexuella och apomiktiska typer, som kan uppträda »inom arten».

**27 maj.** Exkursion till sydöstra Skåne ägde rum under ledning av laborator NILS MALMER och professor HENNING WEIMARCK. Exkursionen, som företogs med privata bilar, samlades vid Röddinge. Route: Röddinge—Fylan—Lyckås—Benestad—Övraby—Tosterup—Glemminge—Kåseberga—Hammenhög (där exkursionen upplöstes).

Första anhalt gjordes på den lilla vägen c. 1 km sydöst om Röddinge kyrka,

varifrån deltagarna förflyttade sig till fots till skogsområdet c. 500 m söder om Röddingeberg. Här höll professor WEIMARCK en kort presentation av Fyledalen, och laborator MALMER beskrev de olika skogstyperna, som finns på platsen. I den delvis starkt sluttande terrängen kan en tydlig differentiering i fältskiktets flora iakttas, vilken kan korreleras med markens skiftande fuktighetsförhållanden. På fuktiga ställen kring bäckar dominerar *Petasites albus*; i anslutning härtill följer en *Allium ursinum* - zon, som avlöses av *Mercurialis perennis*. Den torrare delen av sluttningen karakteriseras av ett *Galium odoratum* - samhälle, som på krönet av en kulle uppträder i en artfattig variant.

Nästa gång stannade man vid Benestads kyrka och vandrade sedan till det fredade området c. 500 m västnordväst om kyrkan (»Benestads backar«). Studiet av flora och vegetation på denna lokal försiggick i ett stundom kraftigt strilande regn. Trots detta kunde i *Schoenus* - kärret antecknas *Dactylorhiza majalis*, *Primula farinosa* och *Valeriana dioica*. I de (vanligtvis) torra sluttningarnas gräsmark kunde på vissa ställen ses *Senecio integrifolius* (ännu ej blommande); och särskilt längs upptrampade stigar fanns många och stora exemplar av *Hutchinsia petraea*.

Vid Kåseberga besöktes den välkända skeppssättningen »Ales stenar«, var- efter exkursionsdeltagarna klättrade nedför branten mot Östersjön. I denna sluttning noterades bl. a. *Arenaria serpyllifolia*, *Artemisia campestris*, *Capsella bursa-pastoris*, *Cerastium semidecandrum*, *Holosteum umbellatum*, *Hutchinsia petraea*, *Geranium molle*, *Myosotis hispida* och *stricta*, *Saxifraga tridactylites*, *Senecio vernalis*, *Stellaria media*, *Veronica triphyllos* och *Vicia lathyroides*.

I den nedre delen av branten hittades på några ställen *Asparagus officinalis*, *Lithospermum arvense* v. *caerulescens* och *Alyssum alyssoides*. Bland klappern på stranden växte *Honkenya peploides*. Slutligen kan från mera ruderatbetonade ställen nära Kåseberga hamn nämnas *Lamium album*, *Onopordum acanthium* och *Stellaria apetala*.

**19 september.** Exkursion företogs med buss till nordvästra Skåne. Route: Lund—Ängelholm—Skäldervikens strand (vid Ängelholm)—Ängelholms havsbad—Munka-Ljungby—Herrevadskloster—St. Nybo (Riseberga sn)—Bandsjön (Riseberga sn)—Spången—Lund. Första exkursionsmålet var Skäldervikens strand i Ängelholm nära gränsen till Strövelstorps socken. En frisk kuling blåste in från Kattegat, vilket gav en uppfattning om vindens och vågornas roll för strandens och vegetationens utformning. På den s.k. förstranden växte *Honkenya peploides*, *Salsola kali*, *Atriplex latifolia* och *A. sabulosa*. Den sistnämnda, som naturligt nog mest tilldrog sig intresset, hade påträffats under sommarens inventeringsarbete av MATS GUSTAFSSON. *Atriplex sabulosa* fanns just i den nedersta kanten av dynvegetationen, där *Ammophila arenaria* började uppträda.

Anhalt nr två var Ängelholms havsbad, där en lokal ett par hundra meter öster om havsbadet i närheten av Rönne å skulle studeras. Här hade på ett område med *Molinia*-äng grästorv upptagits. Strängar av ängen fanns kvar, och på ytorna mellan dessa härskade ett igenväxningsstadium med ännu ej sluten vegetation: En gles *Phragmites*-vass, där i det lägre fältskiktet en rik förekomst av *Centunculus minimus* var särskilt värd att lägga märke till. På grund av den hårda pålandsvinden hade emellertid knutarvslokalen mer eller

mindre övergått till havsbad, och *Centunculus* befann sig på 40 cms vattendjup, varför den intressanta lokalen dessvärre inte inbjöd till besök ens med svenska normalstövlar.

I Munka-Ljungby, som inventerats av BENGT BENTZER, studerades floran utmed Rössjöholmsån vid Munka-Ljungby kvarn. Från en stenbro hade man god utblick över de stora *Osmunda*-ruggarna nere vid ån. Hundra m ovanför bron fanns *Leersia oryzoides* dock svåråtkomlig vid då rådande höga vattenstånd i ån.

I Riseberga socken gjordes först halt c. 600 m VNV Herrevadskloster för besök på de delvis kärrartade betesmarkerna utmed Rönne å. Här finns en av denna sockens få rikkärrslokaler, bl.a. förekommer *Epipactis palustris*. På av kreaturen upptrampad fuktig mark kunde man finna *Isolepis setacea* och *Glyceria declinata*.

Tvåhundra m NÖ St. Nybo underkastades vägkanterna utmed en mindre grusväg en intensiv granskning. Här förekom bl.a. *Centunculus minimus*, *Radiola linoides* och *Juncus bufonius*.

I det så småningom allt bättre vädret avslutades dagens floristiska studier vid Bandsjön (c. 800 m N Riseberga kyrka). Å den omedelbart V sjön belägna mossen fanns ett bestånd av *Scheuchzeria palustris* i en igenväxt torvgrav. Kallgräset befann sig i vackert fruktstadium. I kanten av en annan igenväxt torvgrav hittade ARNE H. HOLMQVIST en liten buske av *Ledum palustre*. Efter detta fynd visade det sig, att flera *Ledum*-buskar fanns i den tallbevuxna randzonen av mossen (jfr WEIMARCK 1947: Natur i Skåne sid. 255).

**4 november.** Till styrelse för år 1966 valdes professor H. WEIMARCK, ordf., docent O. ALMBORN, v. ordf., undertecknad, sekr., fil. stud. G. MATTIASSON, v. sekr., samt lic. F. ANDERSSON, lic. S. O. FALK, laborator B. LÖVKVIST, docent H. RUNEMARK och lic. S. O. STRANDHEDE.

Till revisorer valdes lic. S. SNOGERUP och lic. S. PETTERSSON samt såsom suppleanter lic. L. O. BJÖRN och docent R. DAHLGREN.

Laborator NILS MALMER höll föredrag om Sydsveriges regionala växtgeografi. Föredragshållaren diskuterade olika växtgeografiskt grundade gränslinjer inom Sydsverige, gav exempel på där förekommande floristiska element och skildrade områdets kända vegetationstyper. Som sammanfattning belystes den växtgeografiska differentieringen i Sydsverige från ekologisk ståndpunkt.

**9 december.** Professor KAI LARSEN, Aarhus, höll föredrag om »Indtrykk fra botaniske undersøgelser i Thailand». Under föredraget skildrades några danska botaniska expeditioner företagna i Thailand i samarbete med landets myndigheter. I anslutning till expeditionsberättelsen gav föredragshållaren en beskrivning av bl.a. den tropiska regnskogen i landets södra del och av monsunskogarna i den norra delen. Vidare gavs en mycket instruktiv skildring av risodlingens praktik.

JAN ERICSON

## Litteratur

HELMUT J. BRAUN: *Die Organisation des Stammes von Bäumen und Sträuchern.* — Stuttgart (Wissenschaftliche Verlagsgesellschaft M.B.H.) 1963. XII+162 pp. 137 figs. Price DM. 40:—.

In the first two chapters (92 pages) the cell types, tissues and tissue systems in stems are dealt with. The third chapter (28 pages) is devoted to the functions of tissues and tissue systems, and the fourth (20 pages) to the organization of the wood. The characteristics of the species investigated (157) are brought together in a table. Most space is devoted to the mature stem, and the primary structure is treated rather briefly. Node anatomy is not mentioned. The species more fully discussed are mainly European, but this material is supplemented with a great number of species from other parts of the world.

Wood is composed of few cell types only, but they vary in many respects and may be combined in an astonishing number of ways. Almost every genus can be recognized from the characteristics of its wood. Within the plentiful material the author has distinguished fourteen organization types. They have been arranged into series, each with several organization levels. On the lowest level is the gymnosperm type (with tracheids and ray parenchyma only). From this the series radiate. On higher levels are the many types found among angiosperms (and also *Ephedra* and *Gnetum*). They show stronger differentiation (have vessels and fibers also and more specialized cells) and more elaborate organization (water conduction is more or less restricted to the vessels). When the material is systematized in this way, it suggests the use of an evolutionary point of view. The author does so, with appropriate caution.

The book treats thoroughly a subject, which is usually touched upon in a cursory way in textbooks of anatomy. The distribution in space of the cell types is described in great detail, and the relations between structure and function are continually stressed. The many excellent figures (drawings and photomicrographs) are well chosen and instructive. There are a few criticisms of the layout, e.g., there is no species index and the table mentioned above is not clear enough in arrangement and typography.

Thanks to the thorough treatment of elementary things hardly any previous knowledge is required from the reader. The book is thus an excellent introduction to the study of the mature woody stem. To taxonomists it affords many things of interest.

K. H. MATTISSON

**The Plant Cover of Sweden.** Acta Phytogeographica Suecica 50. — Almquist & Wiksell, Uppsala 1965. X+314 pages, 118 photos, 35 maps, 13 diagrams and 12 tables. Price: Sw. Kr. 72:—, clothbound Sw. Kr. 87:—.

Acta Phytogeographica Suecica, issued by The Swedish Phytogeographical Society, has presented its fiftieth volume. For the second time since the foundation of the Society in 1923 a symposium has been published. The first one in 1940 was a phytogeographical study dedicated to the late Professor CARL SKOTTSBERG and the present one has been dedicated to a conspicuous leader of geobotany in Sweden, Professor G. EINAR DU RIETZ in celebration of his seventieth birthday on the 25th of April 1965. With this survey of the general features of Swedish vegetation pupils and friends wish to honour this prominent scientist and teacher.

In the preface the Editorial Committee has given some points of view, which ought to be considered in a review. "The scope of the book is naturally wide but problems of method, technique or classification and other specialized aspects of research have generally been left aside. We have thought it proper that the survey, although far from being a manual, should be written in an international language, so that its contents may be available to naturalists and friends of Scandinavia throughout the world. We also wish to relieve ourselves of the blame for our previous reluctance to share with the outside world the results of geobotanical investigations in our homeland, a country where, fortunately, the landscape and its plant covering is not yet so grossly worn down or destroyed as in more heavily populated or ruthlessly exploited countries."

The contents of the book are divided into four sections: Regional Survey (6 papers), Aspects of the South (12 papers), Aspects of the North (11 papers) and finally Past and Present (4 papers). In all 34 authors have contributed to this work.

The introductory chapter, written by the foremost authority of this survey Professor H. SJÖRS, treats the physiographic and climatic conditions of Sweden. It is a well illustrated contribution, which gives plenty of information and necessary background to those who are not familiar with the country.

Regional aspects of the marine, benthic vegetation have been given by M. WERN. Contributions concerning the west coast, by J. SÖDERSTRÖM and P. E. LINDGREN, deal with special problems such as vertical zonations and distribution of algae due to gradients of salinity and pollution. S. PEKKARI for his part has studied the extreme conditions in the northernmost part of Bothnian Bay.

The coastal vegetation has been treated in two ways, partly provincially and partly thematically. Provincial descriptions from the county of Bohuslän and the Bothnian coast have been written by H. P. HALLBERG and E. SKYE respectively. There is a survey of the salt marshes of South Sweden by V. GILLNER, and the paper "Maritime sands" by B. PETTERSSON contains notes on coastal sand vegetation, including vegetation with *Corynephorus* and *Koeleria*.

In the paper "The vegetation of Swedish lakes" G. LOHAMMAR gives regional aspects of limnic vegetation. Provincial contributions regarding living

and lost lakes and rivers in northern Sweden have been written by L. GRANMARK, S. PEKKARI, N. QUENNERSTEDT and G. WASSÉN.

Terrestrial vegetation in Sweden is dominated by forests in most parts and these form a basis for a regional dividing of the country. H. SJÖRS has in the chapter "Forest regions" discussed the biotic or vegetation regions. Here some notes are also given on distribution, ecology and floristic features of the forests. These regions are named according to a terminology adapted by SJÖRS in 1963, viz., nemoral, boreo-nemoral and boreal regions or zones. Terms of this kind indicate the affinity to larger regions in an obvious way.

Another paper which elucidates the regional division of the country ought to be mentioned. It is a contribution by S. FRANSSON, which treats the borderland between the boreo-nemoral and the boreal regions. In addition the mountain regions are presented in two papers by S. KILANDER and O. RUNE respectively.

A very characteristic feature of the research of Swedish plant cover has for a long time been the study of mires, and this tradition has given rise to a rather good knowledge of these elements of the landscape. The results of these investigations are surveyed by N. MALMER, H. SJÖRS and Å. PERSSON, who in the following order treat southern, northern and mountain mires. The vegetation of northern mires is also dealt with in descriptions from the county of Jämtland by F. BJÖRKEBÄCK and Y. NORDQVIST. The micro-vegetation of a mire is described by T. FLENSBURG.

In order to complete the presentation of "Aspects of the South" the following titles should be mentioned: "The south-western dwarf shrub heaths" by N. MALMER, "Gotland and Öland. Two limestone islands compared" by B. PETTERSSON, "Vegetation on coastal Bohuslän" by H. P. HALLBERG and R. IVARSSON, "Stipa pennata and its companions in the flora of Västergötland" by L. FRIDÉN and finally "The growth on rock" by E. VON KRUSENSTJERNA.

Among the sequence of papers in "Aspects of the North", only those treating mountain vegetation have not yet been mentioned. O. GJÆREVOLL and K.-G. BRINGER describe the alpine vegetation. A paper by H. HOLMEN may be mentioned in this connection. It deals with pre- and subalpine tall herb vegetation in an area with oceanic influence and it gives some notes on the nutrient economy of this environments.

In the last section of the book, "Past and Present", M. FRIES gives a survey of the late-quaternary vegetation. The influence of Man, too, is treated. Special information on this subject is given by B. PETTERSSON in a paper "Recent changes in flora and vegetation". The previous sections, however, also contain many aspects concerning Man as an ecologic factor, and so the influence of cultural exploitation on Swedish vegetation is well documented.

From what has been reported here it will be seen that the symposium touches upon most fields of ecology in Sweden. Although it has been said that the volume should not be equated with a manual, its purpose in reality comes very close to that and in practice it will probably be used as such. This is only to be expected, since a proper survey of Swedish vegetation in an international language has for a long time been urgently needed.

If one is to use this volume as a manual, however, there are some practical details lacking, especially a brief survey or index of described plant commu-

nities. Perhaps such a brief survey could also indicate more properly to what extent Swedish vegetation is actually investigated. Another point of difficulty for the reader may be the absence of an index to plant species. Facilities of this kind would make it possible to pick out special details with only short descriptions, such as *Koeleria*-vegetation.

These criticisms should not lessen the indisputable value of "Plant Cover of Sweden". It is of greatest importance that for the first time a presentation has been achieved in an international language of the results of Swedish plant ecologic research. The many references in the text give in summarized form an almost complete bibliography of Swedish geobotanical literature written in Swedish or in other languages. The publishing of this symposium will certainly increase the knowledge of geobotanic research in Sweden.

Last but not least it should be mentioned that this important Acta Phytogeographica Suecica is, like all the other numbers in the series, a most well presented volume.

FOLKE ANDERSSON



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*Trycho Norlin*

# TYCHO NORLINDH

ÄGNAS DENNA SKRIFT

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## Die sukkulenten Senecionen Südwestafrikas

Von HERMANN MERXMÜLLER

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Meinen Übersichten über die sukkulenten Pelargonien (MERXMÜLLER 3) und Othonnen (MERXMÜLLER 4) Südwestafrikas soll nun hier noch eine Darstellung der sukkulenten Vertreter der Gattung *Senecio* s. lat. in diesem Gebiet angeschlossen werden. Es ist mir nicht nur eine gerne erfüllte Verpflichtung, sondern eine aufrichtige Freude, gerade diese kleine Arbeit meinem verehrten Kollegen TYCHO NORLINDH widmen zu dürfen, dessen verdienstvoller Forschungstätigkeit so richtungsweisende Fortschritte in der Kenntnis der afrikanischen Compositen zu danken sind.

Bei der Behandlung der sukkulenten Senecionen ist stets zunächst die Frage voranzustellen, wie mit der Gattung *Kleinia* verfahren wird — heute umso mehr, als JACOBSEN in seinem bekannten Buch (1954) sowie zusammen mit ROWLEY (1) erneut für eine Einbeziehung in *Senecio* eingetreten ist. Freilich wurden dafür keinerlei neue Argumente beigebracht, sondern lediglich das alte der unbestreitbar engen Verwandtschaft wiederholt, wie dies bereits von C. H. SCHULTZ, BENTHAM und HOOKER dargelegt wurde. Die Verfechter dieser These pflegen allerdings zu übersehen, daß bei den so überaus intrikaten Beziehungen innerhalb der *Senecio*-Verwandtschaft dann auch eine ganze Reihe heute widerspruchslös als eigene Gattungen geführter Formenkreise ebenso gut und mit demselben Recht in die Monstergattung *Senecio* einbezogen werden könnten; ich erinnere an *Crassocephalum*, *Ligularia* und selbst an *Othonna*, deren Gattungsscharaktere mitnichten „besser“ sind als die von *Kleinia* und teilweise ebenso in ähnlicher Form bei einzelnen Arten von *Senecio* s. str. wiederkehren. Vor allem gilt dies natürlich auch für *Emilia*, an deren Gattungsberechtigung trotzdem seit S. MOORE und vor allem seit der zusammenfassenden Darstellung GARABEDIANS keine Zweifel mehr angemeldet wurden. Es ist mit aller



Schärfe zu betonen, daß eine Einbeziehung von *Kleinia* in *Senecio* zu allermindest auch die Aufrechterhaltung von *Emilia* unmöglich machen würde.

JACOBSEN glaubte, eine Überführung der Kleinien zu *Senecio* würde „Klarheit in die verworrene Nomenklatur“ bringen und weniger Umbenennungsschwierigkeiten bereiten als das umgekehrte Vorgehen; es wurde dabei aber offensichtlich übersehen, daß das Vorliegen zahlloser älterer Homonyme bei *Senecio* hier die Schaffung einer beträchtlichen Zahl völlig neuer Namen erzwingt. Ein Blick auf die nachfolgende Veröffentlichung von JACOBSEN u. ROWLEY (1) belehrt über das Ausmaß des hier entstandenen Unheils. Zudem wird selbstverständlich durch die Führung unter *Senecio* ein Überblick über die bereits beschriebenen Kleinien immer schwieriger. So hätte ROWLEY (1) wohl kaum übersehen, daß sein neubeschriebener „*S. iosensis*“ mit dem längst gültig benannten *S. klinghardtianus* identisch ist, wenn dieser den Gattungsnamen *Kleinia* getragen hätte.

Selbst von den Verfechtern einer Einbeziehung von *Kleinia* in *Senecio* wurde nie bestritten, daß *Kleinia* eine durchaus natürliche, morphologisch und geographisch gut umgrenzte Formengruppe darstellt; auch HOFFMANN, der im Gefolge BENTHAMS *Kleinia* zu *Senecio* stellte, sah sich ja zur Schaffung einer eigenen Untergattung — ebenso wie für *Emilia* — genötigt. Wenn man schon BERGERS (1, 2) praktischen Überlegungen nicht folgen zu können glaubt, so sollte man jedenfalls an den wissenschaftlichen Argumenten eines so ausgezeichneten Systematikers wie STAPF und den ebenso fundierten Ansichten so erfahrener Compositenkenner wie S. MOORE und COMPTON nicht bedenkenlos vorübergehen. *Kleinia* ist und bleibt durch ihre deutlichen (halbkugeligen bis kurzkegeligen) Anhängsel der Griffelarme von allen echten *Senecio*-nen ebenso scharf getrennt wie *Emilia*; die immer vorhandene Stamm- oder Blattsukkulenz, das Vorherrschen weißer und roter Kronenfarben und das stete Fehlen von Zungenblüten unterstreichen die Verschiedenheit. Das vom Kap bis zu den Kanaren und nach Indien reichende Areal ist uns von anderen sehr natürlichen Gattungen (z.B. *Ceropegia*) wohl vertraut.

Ich habe mich bemüßt gefühlt, diese Fragen noch einmal eingehend durchzudenken, da ich weit lieber meinen geschätzten Kollegen gefolgt wäre, schon um nicht in die von ihnen angebahte Vereinheitlichung der Gartennamen neue Mißverständnisse hineinzubringen. Nach dem eben Dargelegten sehe ich mich jedoch zu meinem Bedauern nicht in der Lage, auf diese Linie einzuschwenken. Für die Darstellung der

südwestafrikanischen Formen ergibt sich daraus die sehr einfache Situation, daß die Sukkulente mit goldgelben Zungenblüten unter *Senecio*, die mit ausschließlich röhrigen, weißlichen Blüten unter *Kleinia* zu führen sind.

### Senecio

Die drei aus Südwestafrrika bekannten Arten finden sich ausschließlich im südlichsten, Oranje-nahen Teil des Gebietes und scheinen die Linie Klinghardtgebirge—Obibberge nach Norden hin nicht zu überschreiten; sie stellen offensichtlich Ausläufer von Namaqua-Elementen dar.

#### Schlüssel:

- 1 Krautige Pflanzen mit langen, kriechenden, nichtblühenden Achsen und kurzen (bis ca. 10 cm hohen) aufrechten Stengeln; diese stets einköpfig, im unteren Teil mit gedrängten, 1—3 cm langen Blättern: . . . 2. *S. bulbinifolius*
- 1 Strauchige, deutlich verholzte Pflanzen, über 20 (bis 100) cm hoch. Köpfchen meist zu mehreren an den Zweigenden.
  - 2 Köpfchen zu 1—3 an den Zweigenden; Blätter kurz, nicht über 5 cm lang, abgerundet mit aufgesetztem Spitzchen: . . . . . 1. *S. aloides*
  - 2 Köpfchen zu vielen an den Zweigenden rispig gehäuft. Blätter 5—10 cm lang, etwas sichelig gekrümmt, fein zugespitzt: . . . . . 3. *S. corymbiferus*

#### 1. *Senecio aloides* DC. Prodr. 6: 402 (1837).

Typus: DRÈGE, "in Africa Capensi ad Klein-Namaqualand in Carro" (G-DC).

Synonyme: *Othonna rhopalophylla* Dinter, Feddes Rep. 19: 140 (1923) — (Typus: DINTER 4694, "4 km östlich Pomona an Quarzithügeln").

*Senecio rhopalophyllus* (Dinter) Merxm., Mitt. Bot. München 2: 82 (1955).

Bis 40 cm hoher, sukkulenter, kahler, sparrig verzweigter Strauch mit glatter, graubrauner Rinde. Blätter an Kurztrieben dicht gedrängt, keulenförmig, bis 25 : 5 mm lang und dick, vorne abgerundet und mit aufgesetzten Spitzchen, rundum mit 8—10 deutlichen Längslinien und oberseits mit einer tieferen Längsfurche; Blätter der Langtriebe länger, linealisch-stielrund, 40—50 : 4—5 mm lang und dick. Köpfchen zu 1—3 an den Zweigenden; Köpfchenstiele 1—3 cm lang und ca. 2 mm dick, mit einigen kleinen, schuppenförmigen Hochblättern besetzt, Außenhülle aus etwa 5 ähnlichen Schuppen gebildet. Hüllblätter ca. 8—10, gelegentlich paarweise verwachsend, linealisch, 10 : 1,5 mm, berandet, stumpflich, an der Spitze mit winzigen Haaren besetzt. Zungenblüten ca. 8, Scheibenblüten zahlreich. Achänen ca. 3 mm lang, behaart, mit 10 mm langen, weißen Pappusborsten.

Verbreitung in Südwestafrika (Distr. Lüderitz-Süd): 4 km östlich Pomona an Quarzithügeln, leg. DINTER 4694 (n.v.). — Pomona, 21.5.1929 leg. DINTER 6384 (M). — Gipfel des Dreikugelberges im Klinghardtgebirge, leg. SCHÄFER 570 (n.v.).

Die südwestafrikanischen Pflanzen, von denen ich leider keinen Typusbogen, wohl aber eine spätere Aufsammlung vom gleichen Fundort einsehen konnte, stellen offensichtlich eine Xeromorphose der DeCandolleschen Sippe dar, bei der die meisten Blätter stark verkürzt, bis fast keulig-rundlich ausgebildet sind; auch die Infloreszenzstiele sind hier nicht so extrem langgestreckt wie bei den südlicheren Formen. Die „fünf sehr breiten Hüllblätter“, die DINTER beschreibt und derentwegen ich früher an eine Zugehörigkeit zu *S. aloides* nicht zu glauben vermochte, scheinen mir gelegentliche Mißbildungen darzustellen (vielleicht verursacht durch eine Nicht-Trennung von je zwei normalen Hüllblättern); jedenfalls sah ich neben Köpfchen mit einzelnen breiten Hüllblättern (neben normalen) auch solche mit der für *S. aloides* typischen Garnitur von ca. 10 gleichförmig schmäleren.

Aller Wahrscheinlichkeit nach gehört zu dieser Sippe wirklich auch der eine Bogen von THUNBERGS „*Cacalia arbuscula*“ (Nr. 1 in UPS); jedoch ist erfreulicherweise eine Umkombination nicht erforderlich, da der Thunbergsche Name durch DE CANDOLLES Umkombination in „*Doria arbuscula*“ als auf den Bogen Nr. 2 (in UPS) emendiert gelten darf.

## 2. *Senecio bulbinifolius* DC. Prodr. 6: 402 (1837), „*bulbinefolius*“.

Typus: DRÈGE, „in Africae Capensis distr. Carro ad Klein Namaqualand“ (G-DC).

Niedrige, nicht verholzende, völlig kahle Pflanze mit unterirdischen Rhizomen und dünnen, unterirdischen, am Boden liegenden oder etwas aufsteigenden, beblätterten, aber nicht blühenden Langtrieben; Blühtriebe aufrecht, kurz, bis ca. 10 cm hoch, mit rötlichem Stengel und Köpfchenstiel und im unteren Teil gedrängten Blättern. Blätter stielrund, 1—3 (—4) cm lang, 3—4 mm dick, etwas spitz, mit wenigen, deutlichen Streifen, oberseits schwach rinnig. Oberer Teil des Stengels blattlos oder mit ganz wenigen, winzigen Hochblättern besetzt, einköpfig. Außenhülle aus wenigen, kleinen Schuppen bestehend, Hüllblätter 8—10, linealisch-lanzettlich, 12—14 mm lang, 1,5—3 mm breit, berandet, stumpflich bis etwas spitz, an der Spitze durch kurze, papillenartige Haare bärtig. Zungenblüten 5—8, Scheibenblüten etwa 30—40.

Achänen 3—4 mm lang, dicht kurzhaarig, mit ca. 15 mm langen, weißen Pappusborsten.

Verbreitung in Südwesafrika (Distr. Lüderitz-Süd): Quarzränder nördlich Obib, 1.9.1963 leg. MERXMÜLLER & GIESS 3431 (M, PRE, Herb. Windhoek). — Neu für Südwesafrika.

### 3. *Senecio corymbiferus* DC. Prodr. 6: 402 (1837).

Typus: DRÈGE, „in Africa Capensi ad Silverfontein, in Klein Namaqualand“ (G-DC).

Synonym: *S. phonolithicus* Dinter, Feddes Rep. 30: 94 (1932) — (Typus: Küstenwüste, auf einem steilen Phonolithberg im westlichen Klinghardtgebirge im roten Sande zwischen losen Phonolithblöcken den ganzen Westhang bedeckend, steril Sept. 1922, DINTER s.n., blühend unter Kultur in Lichtenstein 28. Nov. 1923, DINTER s.n.)

Stark sukkulente, kahle, etwa 30—100 cm hohe Pflanze mit dickfleischigen, später verholzenden und harzmanteligen, unangenehm riechenden Stämmchen und Zweigen. Blätter an den bis 1 cm dicken Endzweigen ziemlich dicht stehend, starr, ± stielrund, leicht sichelförmig gekrümmt, ca. 5—10 cm lang und 5—7 mm dick, nach unten und oben spindelförmig verschmälert, am Ende in eine feine Spitze auslaufend, dicht längsgestreift. Infloreszenzen am Ende der Zweige meist zu mehreren, mehr- bis vielköpfige, bis ca. 10 cm lange Rispen bildend. Rispenstiele mit dünnen, pfriemlichen, nur wenige mm langen Hochblättern besetzt, Außenhülle aus 2 bis 4 ähnlichen Schuppen bestehend. Hüllblätter 8, linealisch, 7—9 (—12) mm lang, 1—2 mm breit, berandet, stumpf, an der Spitze durch kurze, papillenartige Haare bärtig. Zungenblüten 5, Scheibenblüten ca. 15. Achänen 4 mm lang, kurz anliegend behaart, mit ca. 10 mm langen, weißen Pappusborsten.

Verbreitung in Südwesafrika (Distr. Lüderitz-Süd): Schakalsberge, 23.3. 1958 leg. MERXMÜLLER & GIESS 2314 (M); ebd., weiterkultiviert im Bot. Garten München, MERXMÜLLER & GIESS 2666 (M); Granitkuppe bei Rooikop (Udabib), 19.8.1963 leg. MERXMÜLLER & GIESS 3308 (M); Schieferberge bei Lorelei, 21.2.1963 leg. LEIPPERT in coll. VOLK 4208 (M); Klinghardtgebirge, leg. DINTER s.n. (n.v.); Daberasdrift, leg. RANGE 1579 (SAM).

Obwohl in den Herbarien unter dem Namen „*corymbiferus*“ recht verschiedenartige Pflanzen versammelt sind, scheint mir an der Identität der südwesafrikanischen Formen mit den von mir gesehenen Belegen DRÈGES kein vernünftiger Zweifel angebracht — wenn auch die Infloreszenzstiele in Südwesafrika nur selten dieselbe stattliche Länge wie bei den Originalpflanzen erreichen. Die kapländischen Formen sind mit unserer Sippe nicht identisch (NORDENSTAM, briefl.); sie scheinen mir eher dem *S. succulentus* DC. nahezustehen.

### Kleinia

Die Schwierigkeiten, die gewisse Formenkreise dieser Gattung beim Bestimmen von Wildmaterial ebenso wie von Kulturpflanzen bieten und die einer zusammenfassenden Revision immer noch im Wege stehen, liegen zuvörderst in der beachtlichen Variationsbreite unter verschiedenen Wuchsbedingungen. Zudem wurden auch hier ähnlich wie bei den stammsukkulenten Pelargonien viele ältere Arten nach in Europa kultiviertem, also gegenüber den am natürlichen Standort gewachsenen Pflanzen stark verändertem Material beschrieben. Es mag angebracht sein, auf einige besonders kritische Charaktere einleitend hinzuweisen.

So sind die Angaben über die Blütenfarbe sowohl auf Herbaretiketten als auch in früheren Beschreibungen und selbst Abbildungen mit einiger Reserve zu behandeln. Soweit ich aus eigener Erfahrung zu urteilen vermag, ist innerhalb BERGERS § *Kleinia* die Kronenfarbe fast stets weißlich, während die im männlichen Stadium der Blüte prall und weit aus der Krone herausragenden Antheren oft kräftig gefärbt, leuchtend gelb oder aber auch hellpurpurn erscheinen. Auf diese Antheren-, nicht auf die Kronenfarbe dürften viele Angaben über „gelbe“ oder „rote“ Blütenfärbung ebenso wie nuanciertere Farbbezeichnungen wie „weißlichgelb“ oder „weiß mit rötlichem Saum“ zurückzuführen sein. Mit einer Purpurfärbung der Antheren scheint vielfach ein stärkerer Anthocyangehalt der Hüllblätter gekoppelt, die dann dunkel braunrot gefärbt sind und im Extremfall keine weißen, sondern hellviolette Trockenränder zeigen. Es sieht jedoch nicht so aus, als ob sich dieses auffallende Anthocyanmerkmal sippenkonstant verhalten würde; es sollte daher wohl vorerst kaum taxonomische Verwendung finden.

Mit ähnlich großer Vorsicht sind die Angaben über die Achänenbehaarung zu behandeln. Die meisten mir bekannten Sippen sind selbststeril; da die in Kultur befindlichen Formen vielfach nur durch einen einzigen Klon repräsentiert sind, werden hier nur sehr selten reife Achänen gefunden. Selbst in der Natur scheint ein guter Fruchtbesatz nicht häufig aufzutreten. Die typische Achänenbehaarung wird jedoch nur an reifen Früchten ausgebildet, während die steril bleibenden Achänen rudimentäre Behaarung zeigen (— ähnlich wie bei *Othonna*!). So sah ich im Herbar an einigen fruchtbaren Wildpflanzen der *K. radicans* s. lat. dichtborstig behaarte Achänen, wogegen das gesamte übrige mir bekannte Material unreife oder sterile Achänen mit nur

sehr kümmerlicher Behaarung besitzt. Alle Angaben über „kahle“, „nur an den Kanten behaarte“ oder „nur mit Papillenleisten besetzte“ Achänen sollten daher bis zur Kontrolle reifen Fruchtmaterials mit Zurückhaltung gewertet werden.

Daß Blattlänge, -dicke und -sukkulenz nicht nur unter verschiedenen Lebensbedingungen, sondern auch im Jahresablauf erstaunlichen Veränderungen unterliegen können, ist lang bekannt. Darüber hinaus ist jedoch darauf hinzuweisen, daß bei der Beurteilung von Herbarpflanzen stark blattsukkulenter Formen auch die Art des Preßvorgangs zu berücksichtigen ist. Langsam getrocknete, d.h. normal gepreßte Blätter schrumpfen weit stärker ein und erscheinen dann im Herbar weit schmaler als gequetschte oder anderweitig rasch abgetötete, die ihren natürlichen Umfang bewahren.

Während die von BERGER seiner § *Anteuphorbium* zugerechnete *K. longiflora* über ganz Südwesafrika verbreitet ist, sind die übrigen vier, der § *Kleinia* zugehörigen Arten wieder weitgehend auf den Distrikt Lüderitz beschränkt.

#### Schlüssel:

- 1 Stengel kriechend, an den Knoten wurzelnd; Köpfchen endständig, an aufrechten, einfachen oder gegabelten Stielen: ..... 8. *K. radicans*
- 1 Stengel niemals kriechend und an den Knoten wurzelnd.
- 2 Pflanzen mit verdickten unterirdischen Teilen, Horste bildend, mit stark verkürzten, höchstens wenige cm hohen Stämmchen.
- 3 Köpfchen heterogam, mit fadenförmigen, weiblichen Randblüten; Blätter schmallineal, 6—12 cm lang: ..... 4. *K. acaulis*
- 3 Köpfchen homogam, nur mit Zwitterblüten; Blätter im Umriss eiförmig bis kahnförmig, nur 15—35 mm lang: ..... 7. *K. pusilla*
- 2 Pflanzen mit wesentlich höheren oder längeren, deutlich sukkulenten Stämmchen.
- 4 Köpfchen büschelig gehäuft, mit nur 3—10 mm langen Stielen und bis 20 mm langen Hüllblättern; Blätter länglich—linealisch, höchstens 5 cm lang, hinfällig: ..... 5. *K. longiflora*
- 4 Köpfchen in trugdoldigen bis mehrfach gegabelten Infloreszenzen mit bis 25 cm langen Stielen und bis 10 mm langen Hüllblättern; Blätter 5—10 (—25) cm lang, bleibend: ..... 6. *K. pinguifolia*

#### 4. *Kleinia acaulis* (Linn. f.) DC. Prodr. 6: 339 (1837).

Typus: THUNBERG, „habitat in Cap. bonae spei“ („crescit in onderste Roggeveldt“ sec. THUNBERG) — UPS.

Synonyme: *Cacalia acaulis* Linn. f. Suppl.: 353 (1781).

*Senecio acaulis* (Linn. f.) C. H. Schultz, Flora 28: 499 (1845).

Ausdauernde, etwas sukkulente, kahle, krautige Pflanze, horstbildend, mit fleischig verdickten unterirdischen Rhizomen. Blätter an den gestauchten oberirdischen Stengeln schopfartig gedrängt, ca. 6—12 cm lang, 2—3 mm dick, stielrund, am oberen Ende in ein kurzes Spitzchen auslaufend. Schäfte stets einköpfig, die Blätter überragend, ca. 8—15 cm hoch, bis unter das Köpfchen mit kleinen, wenige mm langen, pfriemlichen Hochblättern besetzt. Hüllblätter ca. 13, linealisch, berandet, 14—17 mm lang, 2—3 mm breit, spitz zulaufend, an der Spitze durch sehr kurze Haare etwas bärtig. Randblüten weiblich, fadenförmig, mit kurzer, fast saumloser Röhre; Scheibenblüten zwit- terig, zahlreich, schneeweiß, mit weißlichen Antheren. Achänen be- haart, mit 15—17 mm langen weißen Pappusborsten.

Verbreitung in Südwestafrika (Distr. Lüderitz-Süd): Farm Witpütz-Süd, Granitränder, 27.8.1963 leg. MERXMÜLLER & GIESS 3218 (M, PRE, herb. Wind- hoek); ebd. 3.1958 leg. MERXMÜLLER & GIESS 2561, weiterkultiviert im Bot. Garten München (M); „Aus“, leg. HERRE E 338 nach ROWLEY (2), n.v. — Neu für Südwestafrika.

##### 5. *Kleinia longiflora* DC. Prodr. 6: 337 (1837).

Typus: BURCHELL 1718, „ad Cap. Bonae Spei in regione Trans-Gariepina inter Klaar-Water et Nu-Gariep“ (G-DC) und DRÈGE, „ad Nieuweweld“ (G-DC), Syntypen.

Synonym: *Senecio longiflorus* (DC.) C. H. Schultz, Flora 28: 499 (1845).

Sukkulenter, kahler Kleinstrauch mit etwa 60—75 cm hohen, wenig verzweigten, längsgestreiften und in trockenem Zustand kantigen Stämmchen. Blätter erst nach den Blüten austreibend und rasch wieder abfallend, länglich-linealisch, zugespitzt, bis 5 cm lang und 3—4 mm dick. Köpfchen an den Stammenden und seitlich an Kurztrieben zu 2—6 büschelig gehäuft, auf 3 bis höchstens 10 mm langen Stielen. Hüllblätter 5, linealisch, spitz, ca 18—20 mm lang, 2—3 mm breit, be- randet, an der Spitze mit winzigen Härchen. Blüten 5—6, weißlich mit gelben Antheren. Achänen ca. 4 mm lang, behaart, mit 20—30 mm langen weißen Pappusborsten.

Verbreitung in Südwestafrika: Bisher aufgesammelt in den Distrikten Etosha Pan, Grootfontein, Outjo, Okahandja, Swakopmund, Karibib, Windhoek, Re- hoboth, Maltahöhe, Lüderitz, Bethanien und Keetmanshoop und demnach wohl über das ganze Land verbreitet. (Distr. Etoshapfanne): leg. DINTER I 729 (n.v.). — (Distr. Grootfontein): leg. DINTER I 729 (n.v.); Farm Osombusat- juru, 5.1.1953 leg. H. u. E. WALTER 834 (herb. WALTER). — (Distr. Outjo): Zwischen Outjo und Farm Münsterland, Schwemmlandfläche, 13.2.1953 leg. SCHWERDTFEGER in coll. H. u. E. WALTER 1/340 (M). — (Distr. Okahandja):

leg. DINTER I 729 (n.v.). — (Distr. Swakopmund): Dunkle Berge hinter Station Rössing, 27.8.1929 leg. R. u. F. v. WETTSTEIN 212 (M). — (Distr. Karibib): Farm Otjozondou, am Fuß des Hausberges, 23.2.1953 leg. H. u. E. WALTER 1461 (M); Karibib, Nähe Klippenberg, 19.7.1953 leg. H. KINGES 3532 (M, herb. KINGES); Okomitundu, Namibrand, 23.9.1962 leg. R. SEYDEL 3169 (M); Usakos, leg. E. TWOREK s.n. (M); Usakos, steiniges Gelände, 30.11.1938 leg. O. H. VOLK 145 (M); Salem, leg. DINTER I 173 (n.v.). — (Distr. Windhoek): Farm Friedenau, auf Quarzschotter, 5.1939 leg. G. GASSNER 169 (M); Windhoek, 29.8.1939 leg. S. REHM s.n. (M); Avis Bergland, 10.4.1963 leg. R. SEYDEL 3959 (M); Farm Hohenau, Aloekopf, 16.11.1952 leg. H. u. E. WALTER 2800 (herb. WALTER). — (Distr. Rehoboth): Rehoboth, leg. GÜRICH 97 (n.v.); Büllsporter Fläche, leg. DINTER s.n. (n.v.). — (Distr. Maltahöhe): Tsaris-Berge, 20.10.1939 leg. O. H. VOLK 731 (M). — (Distr. Lüderitz-Süd): Felsen um Aus, 1700 m, 10.1906 leg. RANGE 124 (n.v.); Kannus, nördlich Aus, 1450 m, 10.1907 leg. RANGE 551 (n.v.). — (Distr. Bethanien): Fläche um Chamis, 9.1905 leg. SCHULTZE 407 (n.v.). — (Distr. Keetmanshoop): Klein-Karas, 8. 1923 leg. DINTER s.n. (Z).

#### 6. *Kleinia pinguifolia* DC. Prodr. 6: 336 (1837).

Typus: DRÈGE, „in Africa Capensi“ (G-DC).

Synonym: *Senecio pinguifolius* (DC.) C. H. Schultz, Flora 28: 499 (1845).

Ausdauernde, sukkulente, unangenehm harzig riechende Pflanze mit säulenförmigen, nur an der Basis verzweigten, 10—20 cm hohen und 15—25 mm dicken, im Alter sich meist umlegenden Stämmchen; untere Teile blattlos, graurindig, dicht mit wollig-filzigen Blattnarben besetzt, obere saftiggrün, fleischig, beblättert. Blätter der Wildpflanze 5—10 cm lang und 3—5 mm dick (in Kultur bis 25 : 1 cm!), stielrund, zugespitzt, oberseits mit schwacher Längsfurche, bereift. Infloreszenzen an bis 25 cm langen Stielen, gabelig verzweigt bis fast trugdoldig, 4—8-köpfig. Tragblätter bis 5 mm lang, sehr schmal, Außenhülle aus 2—4 fast fädlichen Schuppen. Hüllblätter ca. 13, linealisch, spitz, violett berandet, 9—10 mm lang und 1 mm breit. Blüten weiß, höchstens 20, Antheren violett. Achänen ca. 2 mm lang, kurz behaart, mit ca. 8 mm langen weißen Pappusborsten.

Verbreitung in Südwesafrika (Distr. Lüderitz-Süd): Südlich Witputz, 3.1958 leg. RUSCH & WISS in MERXMÜLLER & GIESS 2611, weiterkultiviert im Botanischen Garten München (M); ebd., weiterkultiviert in Windhoek, 8.1963 leg. MERXMÜLLER & GIESS 3551 (M, PRE); 11 miles S. of Witputs, quartzite kopje just W. of the road, leg. NORDENSTAM 1162 (M). — Neu für Südwesafrika.

Die Identifizierung dieser Pflanze bereitete große Schwierigkeiten, da die Bruchstücke des nur steril gefundenen Materials bei der Kultur in München zu saftstrotzenden Büschen mit bis 50 cm langen Stämmen, zahlreichen, an der ganzen Stammlänge erhalten bleibenden und bis



25 cm langen Blättern und langgabeligen Infloreszenzen auswuchsen. Solche Pflanzen erinnern stark an *K. hanburiana* Dinter, die nach in La Mortola eingebürgertem Material beschrieben wurde, jedoch durch erheblich breitere Köpfe mit über 40 Blüten unterschieden ist — und ganz besonders an *S. chordifolius* Hook.f., dessen fast bis ins einzelne übereinstimmende Abbildung nur durch das Fehlen von Anthocyanen (trotz der in der Beschreibung angegebenen „gelben“ Blütenfarbe scheinen auch bei dieser Art die Kronen weiß und nur die Antheren gelb zu sein) und wohl auch durch das Fehlen der blattachselständigen Wollbüschel abweicht; freilich ist als Herkunftsort dieser nach in England kultiviertem Material beschriebenen Art der Distrikt Albert angegeben, was bei einer Identifizierung mit unseren südwestafrikanischen Pflanzen eine doch etwas unerfreuliche Disjunktion ergeben hätte.

So war es ein Glücksfall, daß ich 1963 in Windhoek dem gleichen Klon entstammende Pflanzen studieren und sammeln konnte, die sich im Garten GIESS ebenfalls zu einem großen Stock entwickelt hatten, jedoch unter den dortigen trockenen Freilandbedingungen ein völlig anderes Aussehen zeigten. Hier waren die Stämmchen niedrig geblieben, etwas verholzt und grau berindet, dicht mit den wollfilzigen Blattnarben besetzt; die erheblich dünneren Blätter erreichten nur Längen von 5—10 cm und auch die in München so auffällig mehrfach langgegabelten Infloreszenzen erschienen stärker kontrahiert und reduziert. Die magersten Stücke des in Windhoek gezogenen Materials stimmen nun aber so vollkommen mit dem Typusexemplar von *K. pinguiifolia*, dem einzigen mir bekannt gewordenen Stück dieser Art überein, daß an ihrer Identität kein Zweifel bestehen kann. Der Fundort der Pflanze DRÈGES scheint nie ermittelt worden zu sein; auf Grund des uns nun vorliegenden neuen Materials steht zu vermuten, daß die Typusstücke dem angrenzenden Namaqua Broken Veld entstammten.

7. *Kleinia pusilla* (Dinter) Merxm. Mitt. Bot. München 2:331 (1957).

Typus: DINTER 4695, „Klinghardtgebirge, auf Quarzitbergen“.

Synonyme: *Othonna pusilla* Dinter, Feddes Rep. 19:139 (1923)

*Senecio klinghardtianus* Dinter, Feddes Rep. 30:95 (1932), nom. nov.

*Senecio pusillus* Dinter ex Range, Feddes Rep. 39:58 (1935), nom. nud.

*Kleinia pusilla* Dinter ex Range, l.c., nom. nud. in syn.

*Senecio iosensis* G. Rowley, Nat. Cact. & Succ. Journ. 13:32 (1958) —

(Typus: Orange River, Sendlingsdrift, HERRE 7840).

Ausdauernde, niedrige, sukkulente, krautige Pflanze, horstartig wachsend, mit fleischig verdickten Wurzeln, kahl bis auf kleine Haar-

büschel in den Blattachseln. Stämmchen aufrecht, wenig verzweigt, 1—5 cm hoch, bis 1 cm dick. Blätter schopfig gedrängt, etwas bereift, die untersten fast kugelig mit 5—7 mm Durchmesser, die folgenden bootförmig, 15—35 mm lang und 6—10 mm dick, am Grund in einen 1—3 mm langen Stiel zusammengezogen, am oberen Ende etwas zugespitzt, oberseits mit breiter Furche, außerdem mit dunklen Längslinien. Infloreszenz 1-köpfig oder tiefgabelig bis 3-köpfig, 3—10 cm hoch, mit wenigen, nur 2—3 mm langen Hochblättern und ähnlicher, 4—5-blättriger Außenhülle. Hüllblätter 8—13, ca. 10 mm lang, linealisch-lanzettlich, berandet. Blüten ca. 15, weiß, mit gelben (ROWLEY) oder hellpurpurnen (DINTER) Antheren. Achänen schwach und kurz behaart mit zahlreichen weißen Pappusborsten.

Verbreitung in Südwesafrika (Distr. Lüderitz-Süd): Klinghardtgebirge, auf Quarzithbergen, leg. DINTER 4695 (n.v.); Rheinpfalz bei Pomona, auf Dolomit, 21.5.1929 leg. DINTER 6373 (K); am nordöstlichen Ausläufer der Buchuberge, leg. DINTER s.n.; Orange River, Sendlingsdrift, leg. HERRE 7840 (cult. I. O. S. Schutzsamm lung in Zürich); südlich Witpütz, leg. EBERLANZ in MERXMÜLLER & GIESS 2680 und 3490 (M).

Da ich über die etwas verworrene Geschichte und Namensgebung dieser Sippe bereits berichtet habe (MERXMÜLLER 1, 2) ist hier nur auf die zweifelsfreie Identität der Dinterschen Art mit der jüngst von ROWLEY als *S. iosensis* beschriebenen zu verweisen; wollte man die Sippe unter *Senecio* führen, so wäre der regelgerecht gebildete Name *S. klinghardtianus* zu wählen.

8. *Kleinia radicans* (Linn. f.) DC. Prodr. 6: 337 (1837); s.lat.

Typus: THUNBERG, „hab. in Cap. bonae spei“ („crescit in Saldanhabay, Carro alibique“ sec. THUNBERG) — UPS

Synonyme: *Cacalia radicans* Linn. f. Suppl.: 354 (1781)

*Kleinia gonoclada* DC. Prodr. 6: 336 (1837) — Typus: ECKLON, „ad Caput Bonae-Spei in distr. Uitenhagen“ und DRÈGE, „in distr. Albany“, Syn-  
typen (G-DC)

*Senecio radicans* (Linn. f.) C. H. Schultz, Flora 28: 499 (1845)

*Senecio rhopaladenia* Dinter, Feddes Rep. Beih. 23: 66 (1923), nom. nud.

*Kleinia herreiana* Dinter, Monatsschr. Dtsch. Kakt. Ges. 2: 218 (1930),  
nom. nud.

*Senecio adenocalyx* Dinter, Feddes Rep. 30: 96 (1932) — Typus: DINTER 4167, „Groß-Namaland, Aus, in der Mes.-Steppe“ und DINTER 6246, „ebendort“ (n.v.)

*Senecio herreianus* Dinter, Feddes Rep. 30: 180 (1932) — Typus: DINTER 6482, „Groß-Namaland: In den Buchubergen der Küstenwüste“ (M)

*Kleinia gomphophylla* Dinter ex Jacobsen, Sukkulantenkunde 4: 90 (1951),  
nom. nud. in syn.

*Kleinia adenocalyx* (Dinter) Merxm., Mitt. Bot. München 2: 76 (1955)  
*Kleinia herreiana* (Dinter) Merxm. l.c. 77

Sukkulente, kahle, krautige Pflanze mit kriechenden, an den Knoten wurzelnden, etwas kantigen und schwach verzweigten Stengeln. Blätter entlang der Stengel in etwa 5–15 mm Abstand einseitswendig aufrechtsstehend, 15–25 mm lang und 4–6(–10) mm dick, mehr oder minder rasch in einen kurzen Stiel verschmälert, am oberen Ende zugespitzt oder stumpflich und mit kurzem Stachelspitzchen, oft etwas sichelförmig gekrümmt, mit schwachen Längsstreifen und oberseits mit einem breiteren Längs „fenster“, dunkelgrün, oft rötlich überlaufen oder etwas bereift. Köpfchen endständig, zu 1 bis 4 an ca. 5–7 cm langen, z. Tl. tiefgabeligen Stielen; Stiele mit einigen schmalen, ca. 2–3 mm langen Hochblättern versehen, Außenhülle aus etwa 5–8 ähnlichen Schuppen gebildet. Hüllblätter 10–13, linealisch, 10–15 mm lang und 1 mm breit, schmal berandet, spitz zulaufend, kahl oder spärlich bis dicht mit kugeligen Drüsen besetzt, an der Spitze durch sehr kurze Haare etwas bärtig. Blüten 20–25, weiß, mit gelben oder hellpurpurnen Antheren. Achänen 2–3 mm lang, kurz behaart, mit 14–18 mm langen weißen Pappusborsten.

Verbreitung in Südwestafrica: (Distr. Lüderitz-Süd): Granitberge und Hang nördlich Farmhaus Kubub, 20.2.1963 leg. GIESS, VOLK & BLEISSNER 5288 (M. herb. Windhoek); Kububberge südlich Aus, 21.8.1963 leg. MERXMÜLLER & GIESS 3031 (M); ebd. leg. MERXMÜLLER & GIESS 2780, weiterkultiviert im Botanischen Garten München (M); Farm Plateau, östlich Aus, 8.1963 leg. MERXMÜLLER & GIESS 2766, weiterkultiviert im Botanischen Garten München (M); Aus, in der Mes. Steppe, leg. DINTER 4167 und 6246 (n.v.); Aus, leg. HERRE E 332 (ex ROWLEY); in den Buchbergen der Küstenwüste, 1.7.1929 leg. DINTER 6482 (M); ebd., kultiviert im Botanischen Garten München (M). — (Distr. Bethanien): Helmeringhausen, 9.1963 leg. MERXMÜLLER & GIESS 3480, weiterkultiviert im Botanischen Garten München (M).

ROWLEY hat in mehreren Arbeiten (1, 2) darauf hingewiesen, daß die vielfach in unseren Gärten kultivierten Formen der *K. radicans* einen Komplex darstellen, dem diploide, tetraploide und hexaploide Glieder angehören; die einzelnen Formen sind nach Blattgestalt, Blattfarbe, Bereifung und Wuchsform zu unterscheiden und scheinen sich in der Kultur einigermaßen konstant zu verhalten. Nach ROWLEYS Angaben sollen im allgemeinen die Länge der Blätter und die Stärke der Bereifung mit dem Ploidiegrad ansteigen, wenn auch eingeräumt wird, daß klare Korrelationen noch kaum erkennbar sind und die verschiedenen Ploidiegrade konvergent erreicht sein mögen.

Aus Südwesafrika sind bislang nur zwei Formen dieses Komplexes bekannt geworden, die DINTER „*S. adenocalyx*“ und „*S. herreianus*“ getauft hat. Die erstgenannte erscheint im Gebiet um Aus verbreitet; sie ist in allen untersuchten Klonen diploid mit  $2n=20$  und besitzt 20:5 bis 30:8 mm große, eng gestreifte und allmählich zugespitzte, dunkelgrüne Blätter, die sich in keiner Hinsicht von denen vieler in der Cape Province gesammelten Exemplare unterscheiden lassen. Die Blüten sind weiß, an allen unseren Stücken mit hellpurpurnen Antheren. Das einzige Merkmal, das mir ursprünglich größere Beachtung zu verdienen schien, ist die zumindest teilweise recht auffallende Bedrüsung der Hüllblätter. Jedoch zeigte sich in der Kultur, daß der Grad der Bedrüsung in hohem Maße wechselt und bei einzelnen Köpfchen fast gegen Null tendieren kann. Zudem lehrte die Untersuchung des in Kew aufbewahrten Materials, daß über das gesamte Areal des Komplexes hin drüsenlose ebenso wie drüsige Exemplare zu finden sind. (Drüsige: HUTCHINSON 1516 von Addo, ohne Sammler von Uitenhage, ROGERS 956 von Port Alfred, S. A. Exch. Cl. 585 von Grahamstown; schwach drüsige: MAC OWAN 3318 von Laingsburg; drüsenlos: ECKLON & ZEYHER von Zwartkops R., BURKE vom Fish R., BURCHELL 3345 von Somerset, FOURCADE 2586 vom Gamtoos R., DRÈGE 3093 von Uitenhage, HUTCHINSON 3027 von Postmasburg.) Die Auser Vorkommen dürften daher nur eine einzige große Population darstellen, in der die Bedrüsung der Hüllblätter (ebenso wie die Purpurfärbung der Antheren) einigermaßen konstant vertreten ist. Ich sehe keine Möglichkeit, „*K. adenocalyx*“ von *K. radicans* getrennt zu halten.

Etwas schwieriger ist die Beurteilung der „*K. herreiana*“, die ROWLEY (1) durch die Merkmalskombination „stems stouter, to 5 mm thick, shorter; leaves green, berry-like, with symmetrical blunt tips and a small mucro“ von *K. radicans* s.lat. abtrennen zu können glaubt. (Der l.c. zusätzlich damit verglichene *S. abbreviatus* S. Moore ist ein typischer *Senecio* und hat mit unserer Gruppe aber auch gar nichts zu tun — wieder einmal ein Beweis für die Nachteile des „merging“!). Unsere Gartenpflanzen von „*herreiana*“, die wohl noch auf die Dintersche Aufsammlung zurückgehen und mit dem Typusmaterial recht gut übereinstimmen, zeigen auch wirklich einen geringfügig gestauchteren Wuchs; ihre weinbeerenähnlichen Blätter sind etwa 15:8 mm groß, dunkelgrün oder rötlich überlaufen, jedoch ziemlich plötzlich zugespitzt und weniger eng gestreift. Während DINTER die Blüten als „gelblich-weiß“ beschrieb, also wohl Pflanzen mit gelben Antheren sah, besitzen unsere Formen hellpurpurne Antheren; ihre Hüllblätter sind völlig

drüsenlos. Ebenso wie die von ROWLEY gezählten sind auch unsere Pflanzen hexaploid mit  $2n=60$ . Es scheint mir kaum zweifelhaft, daß sich in den Buchubergen ein besonderer, allerdings nur recht geringfügig verschiedener, alles in allem eben noch stärker sukkulenter Ökotyp unseres Komplexes herausgebildet hat.

Schwierigkeiten bereitet nur die Frage seiner taxonomischen Bewertung. Ebenfalls hexaploides, von der Alexanderbay, also aus der unmittelbaren Nachbarschaft stammendes Material (HALL 74/53, cult. in M) zeigt nämlich durchaus verlängerte, *radicans*-typische Stämmchen mit nur 18:5 bis 25:9 mm großen Blättern und ist nun seinerseits von unseren diploiden Pflanzen von Helmeringhausen (MERXMÜLLER & GIESS 3480) in diesen Merkmalen kaum mehr zu unterscheiden. Der von ROWLEY (2) als „typical of herreianus“ abgebildete Blattumriß scheint zu zeigen, daß die Variation in der Blattform sogar noch viel weiter reicht — und eine in der gleichen Arbeit (fig. 1, top) abgebildete Pflanze zeigt, daß es noch wesentlich andersartige hexaploide *radicans*-Formen gibt. So sehe ich derzeit kaum eine vernünftige Möglichkeit, die Buchuberg-Pflanze als eigene Art weiterzuführen. Wer für sie einen eigenen Namen haben will, mag „*herreiana*“ einstweilen im Varietätsrang führen; jedoch liegt es mir ferne, für diesen mutmaßlichen Ökotyp eine offizielle Umkombination vorzunehmen.

### Species excludendae

*Senecio avasimontanus* Dinter, Feddes Rep. 19: 141 (1923) = *Lopholaena cneorifolia* (DC.) S. Moore

*Senecio cactaeiformis* Klatt, Bull. Herb. Boiss. 4: 465 (1896) = *Othonna graveolens* O. Hoffm.

*Senecio pusillus* auct. nec Guss.: „Dinter“ ex Jacobsen (2) = *S. (Kleinia) citriformis* Rowley in Jacobsen & Rowley (1) — stammt nicht aus Südwestafrika!

*Senecio rowleyanus* Jacobsen ex Rowley (2), nom. nud. — stammt nicht aus Südwestafrika!

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## Dryopteris dilatata och Dr. assimilis i Sverige

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I andra uppl. av CLAPHAM, TUTIN & WARBURG: »Flora of the British Isles» (1962 p. 32) liksom i den nyligen utkomna »Flora Europaea 1» (TUTIN et al. 1964 p. 22) finner man närmast efter *Dryopteris dilatata* (Hoffm.) A. Gray en *Dr. assimilis* S. Walker med utbredningen »mountains of Scandinavia, Scotland, Germany, Switzerland and probably elsewhere». Namnet torde vara obekant för de flesta svenska botanister. Det är också blott några få år gammalt (WALKER 1961 p. 607) men avser ej något nytt taxon utan är grundat på *Lastrea dilatata* var. *alpina* Moore från Ben Lawers i Skottland. Ormbunken i fråga finns emellertid i svensk litteratur igenkännligt omnämnd redan 1792 och har upprepade gånger varit föremål för diskussion och skilda tolkningar.

Genom IRENE MANTONS och hennes lärjunge S. WALKERS cytotaxonomiska och genetiska undersökningar har taxonomin inom hela »*Dr. spinulosa*-komplexet» klarnat och det blivit möjligt komma fram till allmänt accepterade artomgränsningar. I sitt redan klassiska, idérika arbete om pteridofyternas cytologi och evolution visade MANTON (1950 pp. 66—78), att *Dr. cristata* (L.) A. Gray och *Dr. spinulosa* (O. F. Müll.) Watt liksom brittisk *Dr. dilatata* voro tetraploida ( $2n=164$ ), under det att exemplar av den senare från Jämtland (Storlien), Norge (Trondheim) och Schweiz (Arolla) voro diploida ( $2n=82$ ) och hade vissa morfologiska särdrag. Det är denna diploid, som erhållit namnet *Dr. assimilis*. Senare anträffade hon (MANTON 1955 p. 94) även tetraploid *Dr. dilatata* i Sverige (Björkö i Stockholms skärgård). WALKER (1955) har visat, att *Dr. spinulosa* och den tetraploida *Dr. dilatata* äro amfidiploider och ha ett genom gemensamt samt att detta genom är det hos *Dr. assimilis* förefintligen. Den senare kan sålunda ej taxonomiskt sammanföras med *Dr. dilatata*, trots de påtagliga morfologiska likheterna

utan måste betraktas som en självständig art. Man får emellertid icke tro, att just denna nutida *Dr. assimilis* skulle ingå i endera eller bägge av de två nämnda tetraploida arterna. Morfologiska skäl tala däremot, och motsvarande genom förefinnes hos åtminstone ytterligare en diploid art, den morfologiskt väl karakteriserade nordöstamerikanska *Dr. intermedia* (Mühl.) A. Gray (WALKER 1961).

Under ett besök i Jämtland sommaren 1963 begagnade jag tillfället att söka efter den Mantonska växten. Jag kom visserligen ej till Storlien men granskade i stället noga all *Dr. dilatata* jag fann på Snasahögarnas sluttning mot Handölsdalen. Efter höjd över havet, markbeskaffenhet och exposition visade den stor variation, men denna var uppenbarligen rent modifierativ och allt måste tillhöra ett och samma taxon. När jag så samma höst undersökte *Dr. dilatata* i Gästrikland och fann denna oskiljbar från mina jämtländska exemplar, började jag tvivla på att jag överhuvud anträffat *Dr. assimilis*. Studier i Uppsala-herbariet gav emellertid snart nog det överraskande resultatet, att allt norrländskt material var denna och att den var spridd ända till Skåne, under det att den växt MANTON betraktade som typisk *Dr. dilatata*, var inskränkt till landets sydligare delar.

Allt väl valt och preparerat material insamlat i rätt utvecklingsstadium, d.v.s. med mogna sporer i behåll, lät sig utan svårighet fördela på de två arterna. Jag ansåg det därför värt försöket att utan cytologiska undersökningar enbart på grundval av befintligt herbariematerial söka fastställa de bägge arternas förekomst i vårt land.

En god del av herbariernas material är emellertid för ungt (utan mogna sporer), för gammalt (med sporerne redan spridda) eller helt utan fruktifikationsorgan. Det förefaller rent av som om många samlare ansett ormbunkar lämpliga att fylla ut sina växtpressar med under tider, då andra växter ej trängas där; maj och början av juni samt september—november äro sålunda vanliga, men föga lämpliga insamlingstider. Äro exemplaren dessutom illa preparerade, blir deras bestämning ytterst besvärlig eller helt omöjlig. — Stora problem erbjuda också de i samlingarna alltför rikligt företrädde »ungdomsformerna» från individ (eller sidoskott), som ännu ej eller knappast nått fortplantningsmognad. Till belastning av ormbunkstaxonomi ha dylika blad alltför ofta beskrivits som skilda varieteter eller former, därest de ej fått mer eller mindre fantasifulla hybridbeteckningar eller helt felbestämts.<sup>1</sup> — Jag fann det därför nödvändigt att uppskjuta slutbearbetningen, tills jag förskaffat mig en viss fälterfarenhet av bägge arterna. Bestämningarna av ett antal ark

<sup>1</sup> Sålunda är den av HÅRD AV SEGERSTAD (1935 p. 229) från Dalsland uppgivna *Dr. filix-mas* × *austriaca* blott en ungdomsform av *Dr. filix-mas* (L.) Schott. De två fynd, som SELANDER (1950 p. 28) publicerat som *Dr. spinulosa*, ny för Lule Lappmark, äro likaledes ungdomsformer av *Dr. filix-mas*.



äro dock fortfarande osäkra, men dessa påverka på intet sätt helhetsbilden av de två arterna och deras utbredning. Sådana lokaler ha ej heller medtagits på kartorna.

De samlingar, som utnyttjats för denna studie äro — förutom UPS — GB, LD, S-PA och UPSV, i allt mer än 1500 ark från vårt land. Jag står i stor tacksamhetsskuld till dessa institutioner och deras tjänstemän.

**Historik.** Det skulle föra alldeles för långt att här i detalj ingå på behandlingen av »*Dr. spinulosa*-komplexet» i äldre taxonomisk litteratur. Blott det viktigaste av vad som direkt angår vårt land, skall här anföras. Först må då konstateras, att LINNÉ uppenbarligen saknade intresse för dessa ormbunkar och att det enda hitförbara namnet i »*Flora suecica*» är *Polypodium cristatum*. Klart fixerat till sin nu gängse betydelse blev detta namn 1787 genom ADAM AFZELIUS, som också gav en mycket god avbildning. Sin tolkning stödde han dels på LINNÉs diagnos, dels på exemplar i »2:ne gamla Samlingar, som framl. Doctorerne SOLANDER och MONTIN gjort här i Upsala under v. LINNÉs egna ögon». — AFZELIUS underströk samtidigt, att de av LINNÉ citerade bilderna ej passa till denna växt och berörde i dunkla ordalag »et annat /*Polypodium*/, äfven i Sverige allmänt, som alldeles liknar de nämde figurerna, men ingalunda kommer öfverens med characteren» utan att dock namnge denna växt, som uppenbarligen är vad som senare blivit känt som *Dr. spinulosa* och *Dr. dilatata* (inkl. *Dr. assimilis*). — *Dr. cristata* har senare ej vållat våra florister nämnvärt bekymmer. Mellanformer till *Dr. spinulosa* iakttogos emellertid då och då. Dessa befunnos sedermera vara hybrider, som visserligen utbildade talrika sporangier men ej dugliga sporer. För Sveriges vidkommande introducerades denna hybrid i litteraturen av ROSENDAHL (1913 p. 285).

*Dr. spinulosa* angavs för första gången som svensk av RETZIUS 1795. Den hade avbildats och beskrivits från Danmark (Sjælland) av O. F. MÜLLER 1767 och namngivits av honom såsom *Polypodium spinulosum* tio år senare. Varken bilderna eller beskrivningarna äro särskilt pregnanta, och avgränsningen gentemot *Dr. dilatata* (inkl. *Dr. assimilis*) förblev länge oklar. — MÜLLERS namn är tyvärr illegitimt såsom ett yngre homonym till *Polypodium spinulosum* Burm.fil. av år 1768. Såsom namn för ormbunken ifråga ha föreslagits *Dr. lanceolato-cristata* (Hoffm.) Alston (= *Polypodium lanceolato-cristatum* Hoffm. 1790) (ALSTON 1957 p. 41) och *Dr. carthusiana* (Vill.) Fuchs (= *Polypodium carthusianum* Vill. 1786) (FUCHS 1959 p. 339). I avvaktan på ytterligare klarläggande av namnfrågan, i vilken även den definitiva tolkningen

av *Polypodium austriacum* Jacq. av år 1764 är involverad, fortsätter jag att här använda namnet *Dr. spinulosa*.

Namnet *Dr. dilatata* (Hoffm.) A. Gray går tillbaka på den av HOFFMANN år 1795 från mellersta Tyskland (sannolikt Harz) beskrivna *Polypodium dilatatum*. Så länge något typexemplar ej blivit undersökt, kan det ej avgöras, huruvida HOFFMANN med sitt namn avsett tetraploiden, vilken MANTON och WALKER betrakta som den äkta *Dr. dilatata*, eller möjligen diploiden, d.v.s. *Dr. assimilis*. Intet i beskrivningen pekar i någondera riktningen, men då tetraploiden synes vara allmän i stora delar av Mellaneuropa är identifieringen sannolikt riktig. Under slutet av 1700-talet och början av 1800-talet nybeskrevos ytterligare ett antal arter inom denna formkrets. Om till äventyrs någon eller några av dessa representera diploiden, måste åtminstone t.v. lämnas oavgjort, varför jag nedan accepterar WALKERS nomenklatur med tillägget »s. WALKER», när tydligheten så kräver.

I vårt land har *Dr. assimilis*, som åtminstone i stora delar av Norrland är allmän och den enda representanten för hela *Dr. spinulosa*-komplexet, uppmärksamrats mycket tidigare än *Dr. dilatata* s. WALKER och figurerar redan i första upplagan av LILJEBLADS Flora (1792). Under *Polypodium cristatum*, varmed trots hänvisningen till AFZELII uppsats uppenbarligen främst *Dr. spinulosa* avsågs, anförde han en namnlös varietet »A», som enligt beskrivning och utbredningsuppgift (»i Norrl. skogar a.») är *Dr. assimilis*, vilket ock bekräftas av ex. i hans herbarium (UPS). I andra upplagan (1798) har sagda varietet fått epitetet »*spinulosum*». — I LILJEBLADS herbarium föreligga två kollektur av *Dr. assimilis*. Den ena, etiketterad endast »*Polypodium cristatum*» utan några som helst fyndomständigheter, kan vara samlad av LILJEBLAD själv under dennes resa till Torne Lappmark 1788. Ett ark i THUNBERGS herbarium (n. 24720, UPS) ursprungligen etiketterat »*Polypodium cristatum* var. — Svecia Liljebblad» och med artnamnet sedermera överskrivet med *spinulosum*, tillhör synbarligen samma insamling. Den andra kollektur i LILJEBLADS herbarium bär anteckningen »BURMAN emellan Marks och Fjäl's gästgg. Medelpad».

Likaledes odaterade exemplar, som sannolikt äro ännu något äldre, föreligga av såväl *Dr. assimilis* som *Dr. spinulosa* och *Dr. dilatata*, samlade av P. OSBECK i Hasslöv (Halland), men dessa ha ej avsatt några spår i litteraturen. Av *Dr. assimilis* ligga två ark i S-PA, varav det ena tillhört ALSTRÖMERS herbarium och i A. DAHL's handstil bär två opublicerade namn *Polypodium hasslofiense* och *P. speluncae*. Av *Dr. spinulosa* förefinnas 5 ark i S-PA, varav 3 från OSBECK's eget herbarium och 2 från ALSTRÖMERS. Ett av de förra bär i OSBECK's hand namnet *Polypodium hasslofiense* men med epitetet senare över-

struket och av någon annan ersatt med *spinulosum*. *Dr. dilatata* slutligen representeras av ett ark i UPS (Herb. THUNBERG n. 24721) under namnet *Polypodium spinulosum*, men ursprungligen i blyerts påskrivet *cristatum*.

Första gången namnet *dilatatum* uppenbarar sig i svensk floristisk litteratur synes vara i WAHLENBERGS Flora lapponica (1812 p. 282), där man finner *Aspidium dilatatum* med en  $\beta$  *spinulosum*. Inom det av honom behandlade området finnes av hela gruppen endast *Dr. assimilis*, varför bägge namnen måste syfta på denna. — I den posthuma tredje upplagan av LILJEBLADS Flora (1816 p. 514) är uppställningen likartad: *Aspidium dilatatum* med en varietet *A. spinulosum*. Både av beskrivningar och av lokalangivelser (huvudarten »på skuggrika ställen r[ar] n [=i de norra provincierna]» och varieteten »i skogar a[llmän]» framgår emellertid, att här med huvudarten avses *Dr. assimilis* och med varieteten *Dr. spinulosa*. — I första upplagan av HARTMANS Flora (1820 p. 369) finnes — förutom *Aspidium cristatum* — endast *A. spinulosum*, vilken säges »var. i hög grad», under det att *A. dilatatum* anses (p. 370) »ännu osäker såsom Svensk». I de följande upplagorna liksom i 1800-talets landskapsfloror betraktas *dilatatum* i regel som en mer el. mindre oskarpt avgränsad varietet eller underart av *spinulosum*.

Det enda originella, på egna fältstudier grundade svenska bidraget till dessa ormbunkars taxonomi under 1800-talet lämnades för jämnt 100 år sedan av K. F. THEDENIUS (1865 pp. 41—42). Denne hade på flera ställen i Bohuslän (på Orust och vid Uddevalla) uppmärksammat en ormbunke, som han först hållit för en ny art och på etiketter kallat *Polystichum bahusiense* men som ELIAS FRIES och pteridologen G. METTENIUS samstämmigt förklarat vara den »rätta *Aspidium dilatatum* Sw.» och väl skild från *Polystichum spinulosum*. THEDENIUS ansåg vidare HARTMANS *P. spinulosum*  $\beta$  *dilatatum* vara »en form af *P. spinulosum* med bredare stamblad men i saknad af de kännetecken, som utmärka *P. dilatatum* Sw.». THEDENIUS för hans tid goda beskrivning samt bevarade herbarieexemplar bevisa till full evidens, att hans »nya» art är *Dr. dilatata* s. WALKER. Hans tolkning av HARTMANS växt var däremot ej alldeles riktig, ty vad den senare åtminstone väsentligen åsyftat är *Dr. assimilis* (jämte i någon mån *Dr. dilatata*). Snart nog fann och igenkände THEDENIUS sin ormbunke även i Skåne (Skärälid). Samma sommar i Östergötland och Skåne anträffad *Dr. assimilis* etiketterade han *P. spinulosum* var. *sub-dilatatum*. Senare synes han ha misslyckats att hålla dessa bägge taxa isär. Ingen av hans samtida fullföljde hans uppslag, och hans iakttagelser råkade i så fullständig

glömska, att ROSENDAHL, när han upptog gruppen till kritisk behandling, ej ens nämner THEDENIUS.

Den nu i Sverige gängse uppfattningen om dessa ormbunkar grundar sig väsentligen på ROSENDAHLS undersökningar (1911, 1913, 1916). Denne farmakolog och pteridolog kom i samband med sina studier över ormbunkars anthelmintiska egenskaper att närmare intressera sig för *Dr. spinulosa-dilatata*-komplexet. Han fann *Dr. spinulosa* och *Dr. dilatata* utgöra två såväl morfologiskt som kemiskt väl skilda arter, ehuru förbundna medelst hybrida mellanformer, än fertila, än med degenerade sporer. Den påtagligaste morfologiska skillnaden fann han ligga i bladskafths- (och bladanlags-) fjällens byggnad. I naturen är denna karaktär alltid lätt att iakttaga. Pressade exemplar med bladskafthen och deras fjäll i behåll låta sig också restlöst bestämmas. Saknaden av glandler hos *Dr. spinulosa* är också mestadels en god karaktär. *Dr. dilatata* (inkl. *Dr. assimilis*) kan emellertid undantagsvis vara praktiskt taget glandelfri. Ehuru felbestämningar alltså förekomma, kan *Dr. spinulosa* nu för vårt lands vidkommande anses ha fått sin definitiva karakterisering.

ROSENDAHLS beskrivning av »hybridens» morfologiska egenskaper är betydligt vagare och påtagligt präglad av en önskan att finna intermediära eller mellan »föräldraarternas» vacklande karaktärer, men han kände sig tydligtvis aldrig helt tillfreds med sina bestämningar. Detta framgår både av hans herbarietiketter och av de skiftande uppgifter han lämnar om »hybridens» förekomst. En kollekt från Torne Lappmark, som 1913 publicerats som hybrid, överfördes 1916 utan att han särskilt påpekade detta, till en då nybeskriven varietet av *Dr. dilatata*, var. *pseudospinulosa*, vilken utgörs av nordliga, småvuxna och ljusbladiga modifikationerna av *Dr. assimilis* (jfr SAMUELSSON 1919 p. 249). Men även hans hybrid i övrigt utgörs enligt hans bestämningar väsentligen av samma art. Det av honom 1913 (p. 291) avbildade bladet är likaledes *Dr. assimilis*. Dess härkomst anges ej i texten men OTTO R. HOLMBERG (enligt anteckning i LD) har anträffat originalet i GORTONS herbarium, insamlat i Madesjö den 25.VII.1909 av S. MEDELIUS. Jag har ej återfunnit detta men sett åtskilliga andra ark av samma kollekt etiketterade »*Dryopteris dilatata* f. *viridis*, minus *glandulosa*», och de äro alla typisk *Dr. assimilis*. — Tyvärr utpekar ROSENDAHL ej heller någon viss kollekt, som skulle utmärkas av »rudimentära» sporer. Hans teckning (p. 292) gör ej något övertygande intryck. De avbildade sporrerna synas snarare vara mycket unga än »rudimentära». HOLMBERG (1922 p. 11) konstaterade också, att han »ej på ROSENDAHLS exemplar» kunde iakttaga den »uteblivna l. reducerade sporalstringen». — Ej

heller redovisar ROSENDAHL, på vilket material han utfört sina kemiska undersökningar. En kontrollundersökning skulle förvisso ha stort intresse och kunna bidra till karakteriseringen av komplexets olika arter.

Under de närmast följande åren tillkommo en mångfald fynd av »hybriden», av vilka åtskilliga även publicerades. Många skarpsynta florister uppmärksammade blandpopulationer, innehållande *Dr. spinulosa*, *Dr. »dilatata»* och en tredje typ, som sålunda »måste» vara hybriden. För botanister från Sydsverige, välbekanta med *Dr. dilatata* s. WALKER blev då — liksom för ROSENDAHL — helt naturligt *Dr. assimilis* den tredje, »hybrida» typen. För botanister bättre bekanta med *Dr. assimilis* var det ej sällan i stället *Dr. dilatata* s. WALKER, som blev »hybriden».

I sin »Handbok» karakteriserade HOLMBERG (1922 p. 11) hybriden blott med orden »mellanformer mellan föräldrarna» och uppgav »torde ej vara sällsynt på ställen, där föräldrarna sammanträffa». Trots att han ej kunnat verifiera den nedsatta fertilitet hos mellanformerna, som skulle bevisa föräldrarnas artskillnad, betraktade han dem som arter.

Stödd på C. CHRISTENSEN behandlade HYLANDER (1941, 1945) två decennier senare *dilatata* och *spinulosa* som underarter av en art, som efter SCHINZ & THELLUNG benämndes *Dr. austriaca* (Jacq.) Woynar och anmärkte (1945 p. 61) blott kortfattat, att mellanformer eller hybrider finnas omnämnda i litteraturen. I en recension påpekade WEIMARCK (1945 p. 470), att *dilatata* och *spinulosa* knappast kunna betraktas som underarter, då de »förekomma båda tillsammans över så gott som hela vårt område (den förra tränger visserligen och i en avvikande typ — måhända en verklig subsp.! — upp i fjällen)». Denna »avvikande typ» är uppenbarligen ROSENDAHLS var. *pseudospinulosa*, d.v.s. fjäll-modifikation av *Dr. assimilis*. SELANDER (1950 p. 8) förfäktade också, att *Dr. »austriaca»* och *Dr. spinulosa* äro skilda arter, »å andra sidan kan den typ av *Dr. austriaca* som förekommer i Lapplandsfjällen möjligen tänkas vara en liten geografisk ras (jfr WEIMARCK l.c.)».

För sin »Nordisk kärlväxtflora» hade HYLANDER (1953 pp. 41—43) underkastat dessa ormbunkar en kritisk granskning med det resultatet, att *spinulosa* och *dilatata* betraktas som skilda arter och att han tar avstånd från alla skandinaviska uppgifter om fynd av hybriden (»det herb.material jag sett med sådan beteckning har, i den mån ej arken upptagit en blandning av båda arterna, utgjorts av från den vanliga typen ngt avvikande *dilatata»*). Han påpekade också den avsevärda variationen hos *Dr. dilatata*, »vilken delvis otvivelaktigt är rent modi-

fikativ men väl även inom vårt omr. delvis torde smhånga med förekomst av olika krom.tal», av vilka då blott det diploida var känt från vårt land. Vidare påpekades att »ex. från de högsta fjällök. åro gmgående små o. ljusa (o. ofta ljusfjälliga)»<sup>2</sup> — Även i det betydligt rikare svenska material jag genomgått stå ej några *spinulosa*-hybrider att finna vare sig med *Dr. dilatata* eller med *Dr. assimilis*, lika litet som några säkra exemplar av hybriderna *Dr. assimilis*×*dilatata*. Då denna i Alperna synes uppstå lätt där föräldrarna sammanträffa, borde den ej heller hos oss vara sällsynt. Några få bristfälliga svenska exemplar kunna möjligen tillhöra denna hybrid, vilken bör eftersökas på lämpliga lokaler liksom även ev. *spinulosa*-hybrider.

**Morfologisk karakterisering.** De egenskaper som redan från början framhåvdes som utmärkande för *Dr. assimilis* voro, förutom kromosomtalet, bladens finare flikighet och den större längden på det nedersta primärsegmentets innersta nedåtriktade sekundärsegment. CRANE (1955) kunde snart nog påvisa en tydlig skillnad i sporer, i det perisporet (=episoret) hos *Dr. assimilis* är tunnare och ljusare och dess taggar mindre och glesare. Denna skillnad visar sig på det svenska materialet pålitlig och lätt att se (Fig. 1).<sup>3</sup> Färgskillnaden är t.o.m. så påtaglig, att den ger sig tillkänna även utan mikroskop, om sporer i större mängd uppsamlas på ett vitt papper och betraktas i starkt ljus, antingen med blotta ögat eller under lupp. Sporstoftet måste dock vara rent och ej uppblandat med avfallna tömda sporangier. Som likare vid bedömningen kan *Dr. spinulosa* tjäna. Denna överensstämmer nämligen noga med *Dr. dilatata* till sporens färg och även någorlunda väl till deras ornamentering.

I senare bearbetningar (CLAPHAM, TUTIN & WARBURG 1962 p. 33; TUTIN et al. 1964 p. 22; WALKER & JERMY 1964 p. 139) preciseras beskrivningen av bladformen till att det nedersta primärsegmentets innersta nedåtriktade sekundärsegment hos *Dr. assimilis* skall vara minst hälften så långt som primärsegmentet, medan det hos *Dr. dilatata* nästan alltid är mindre än hälften så långt som primärsegmentet. Att bladskivan är tunn (hinnaktig) och ljusgrön framhålls också som karakteristika för *Dr. assimilis*. Sedan WALKER & JERMY (l.c.) på sporakaraktern kunnat hänföra herbariematerial från åtskilliga brittiska

<sup>2</sup> I WEIMARCKS »Skånes Flora» (1963 p. 17), läses om hybriderna blott »uppgiven och även insamlad från flera lokaler».

<sup>3</sup> Hos några få svenska kollektioner av i övrigt fullt normal *Dr. assimilis* (bl.a. J.A.N. n. 17951 från Gävle-trakten) avvika sporer från *Dryopteris*-typen genom att perisporet ej är större än sporen och skrynklad utan tätt omsluter denna.

lokaler till *Dr. assimilis*, framhålla de att arten morfologiskt torde vara variabelare än från början antagits. Min granskning av det svenska materialet visar också, att den är minst lika variabel som *Dr. dilatata*.

I Skanderna är *Dr. assimilis* i regel småvuxen och mycket ljus till färgen. Under gynnsamma förhållanden kan den emellertid nå samma storlek som *Dr. dilatata*, när denna är som kraftigast, och detta även längst i norr. Jag har sålunda sett veritabla jätte-exemplar av *Dr. assimilis* (i sällskap med *Matteuccia struthiopteris*) i nordligaste Finland (Utsjoki). — När *Dr. assimilis* växer i djup skugga blir dess grönska mörkare, och den kan då få praktiskt taget samma färg som *Dr. dilatata*. Bladskivan håller sig emellertid alltid tunnare och mjukare än hos den senare. När SAMUELSSON (1919 p. 249) som en dittills opåaktad skillnad mellan *Dr. spinulosa* och *Dr. »dilatata»* anför, att den förra är vintergrön, den senare däremot icke, är det tydligtvis *Dr. assimilis* (och ej *Dr. dilatata* s. WALKER) han har i tankarna. Bladen hos *Dr. dilatata* synas nämligen åtminstone ofta övervintra fullt friska, varom vittna herbarieexemplar insamlade i maj. — En bladkaraktär, som först antyddes av THEDENIUS (1865 p. 45) kan här tillfogas, näml. att småflikarna hos *Dr. assimilis* — liksom hos *Dr. spinulosa* — alltid äro plana, medan de hos *Dr. dilatata* åtminstone i regel äro konvexa och detta ej sällan så starkt, att kanten vid pressning blir invikt.

Den angivna skillnaden mellan *Dr. assimilis* och *Dr. dilatata* i det innersta nedåtriktade sekundärsegmentets längd är ej hundraprocentigt giltig. Hos *Dr. assimilis* kan sekundärsegmentet bli avsevärt kortare än som uppgives, och hos *Dr. dilatata* kan det ibland bli så långt att det når normallängden hos den förra arten. I regel ger dock segmentlängden en god ledning vid bestämningar. — Det har också visat sig, att en rad andra karaktärer kunna ge en viss ledning, även om deras variationsamplituder så gripa in över varandra, att man ej kan förlita sig enbart på någon av dem. Sålunda är indusiet hos *Dr. assimilis* i regel sladdrigare till sin byggnad och faller lättare av.

Bladskaftens fjäll ge som bekant den säkraste skillnaden mellan *Dr. spinulosa* och *Dr. »dilatata»*. Hos den förra äro de små och rel. fåtaliga, tunna och blekt bruna utan någon mörkare mittstrimma samt i spetsen rundade och trubbiga (men ej sällan med ett tvärt avsatt, nästan trådlikt, apikalt bihang). Hos *Dr. »dilatata»* äro de större och talrikare (framförallt mot basen), fastare och mörkare samt jämnt avsmalnande i en lång spets, varjämte åtm. en del fjäll (oftast alla eller nästan alla, stundom blott några få av de allra nedersta) ha en mörk mittstrimma av tjockväggiga celler. En viss kvantitativ skillnad

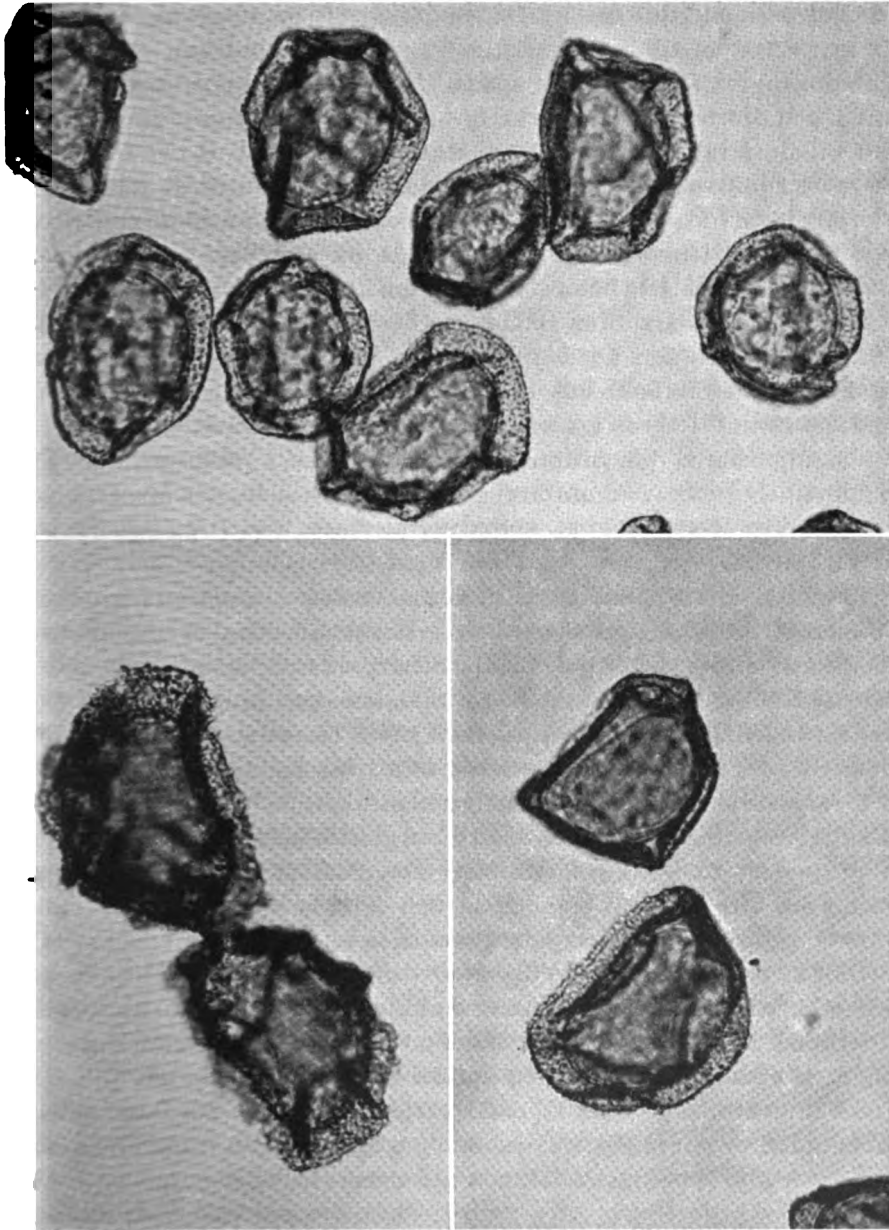


Fig. 1. Sporer av *Dryopteris assimilis* (upptill) och *Dr. dilatata* (nedtill). — Spores of *Dryopteris assimilis* (above) and *Dr. dilatata* (below). — Ca. 600 $\times$ . — J.A.N. n. 17954 (upptill), 19087 (nedtill t.v.) och 19019 (nedtill t.h.).



föreligger emellertid emellan *Dr. assimilis* och *Dr. dilatata*. Den senare är mera extrem till sina karaktärer, vilket kan bidra till att förklara tolkningen av *Dr. assimilis* såsom *Dr. dilatata* × *spinulosa*. Fjällens antal och storlek växlar starkt hos bägge arterna, men *Dr. assimilis* blir sällan så tät fjällig som *Dr. dilatata* normalt är. Hos den senare äro de mörka mittstrimmorna mycket påfallande, ofta inta de större delen av fjällens bredd, och fjäll utan strimmor förekomma blott undantagsvis. Hos *Dr. assimilis* kan man däremot på åtskilliga exemplar (särskilt nordliga) få leta länge, innan man finner några strimmiga fjäll, och strimmorna äro ofta smala. — Fjällens färg växlar starkt; hos *Dr. assimilis* äro de i regel  $\pm$  rödbruna, hos nordliga exemplar kunna de bli nästan rävröda: hos *Dr. dilatata* är färgen i regel mera dämpad, nötbrun. — Även i formen synes en viss skillnad föreligga, i ty att basalpartierna (de nedåtriktade flikar, som  $\pm$  tätt omsluta fästepunkten) hos *Dr. dilatata* i regel äro större och ofta oregelbundet kantiga eller nästan flikiga, under det att basen hos *Dr. assimilis* blott är  $\pm$  hjärtlik.

Bland de mera påtagliga olikheterna mellan *Dr. spinulosa* och *Dr. dilatata* är också, att den förre helt saknar glandler på blad och bladskäft, under det att den senare har sådana. Glandlernas mängd och fördelning är emellertid högst växlande, och praktiskt taget glandelfria individ kunna påträffas inom såväl *Dr. assimilis* som *Dr. dilatata*. Hos den senare äro glandlerna oftast mycket rikliga på bladskäft och rachis men fåtaligare på själva bladflikarna. Hos *Dr. assimilis* är det i regel bladflikarna, som äro rikast glandelbärande. Ej sällan är ej blott under- utan även översidan tätt glandelklädd. Bladskäft och rachis äro ofta (nästan) glandelfria, och detta kan gälla även exemplar, vars bägge bladsidor äro tätt glandulösa.

Då *Dr. assimilis* är diploid och *Dr. dilatata* tetraploid, kunde man vänta sig vissa sådana kvantitativa skillnader mellan dem, som pläga förefinnas inom polyploida serier. Sporerne visa emellertid ingen påtaglig storleksskillnad. Om en statistiskt signifikant sådan till äfven tyrs skulle kunna påvisas, är den i varje fall värdelös för bestämningsändamål. Två andra egenskaper har jag ägnat någon uppmärksamhet. nämligen klyvöppningsstorlek och glandelstorlek. Bägge ha en mycket vid intraindividuell och intraspecifik variationsamplitud, och de bägge arternas amplituder täcka till stor del varandra. Det förefaller dock, som om klyvöppningarna hos *Dr. dilatata* kunna bli längre än hos *Dr. assimilis*, men skillnaden torde knappast vara praktiskt användbar för arternas diagnostisering. Glandlerna synas hos *Dr. dilatata*

genomsnittligt vara något grövre än hos *Dr. assimilis*, och detta gäller såväl de gracilare glandlerna på bladflikarna som de robustare på bladskäft och rachis. En närmare biometrisk undersökning av denna karaktär vore förmodligen lönande.

**Utbredning.** Som redan inledningsvis antytts, är *Dr. assimilis* utbredd över hela vårt land från Skåne till Torne Lappmark. I fjällkedjan är den rikligast i björkbältet men stiger även ofta över skogsgränsen och kan i enstaka individ nå det mellanalpina bältet. På Helagsfjället har den sålunda anträffats på en höjd av 1230 m (SMITH 1920 p. 146), i Sylarna på en höjd av 1460 m (KILANDER 1955 pp. 98—99) och i Sarek på 980 m (ÅBERG 1949 p. 749). — *Dr. dilatata* är däremot inskränkt till landets sydligare delar och når ej fram till »limes norrlandicus». Samtliga kända svenska förekomster av *Dr. dilatata* visas å fig. 2, under det att samtliga svenska fynd av *Dr. assimilis* inom kartområdet inlagts å fig. 3. Inom arternas gemensamma utbredningsområde visa kartbilderna många överensstämmelser. Arterna förekomma också ej sällan tillsammans och synes i det stora hela ha ungefär samma ekologi. Det mest anmärkningsvärda i kartbilderna är *Dr. dilatatas* anhopning mot väster och förkärlek för havsbandet i öster. Frånvaron av bägge arterna från exempelvis västra Södermanland och stora delar av östra Östergötland och östra Småland är också påfallande, men kan bero på brist på insamlingar från dessa områden. I föreliggande skick tillåta kartorna ej några mera detaljerade slutsatser. Det främsta syftet med deras publicering är också att stimulera våra florister till kompletterande undersökningar.

De svenska offentliga samlingarnas material från de nordiska grannländerna är ej särskilt rikt men dock tillräckligt för att göra sannolikt, att de båda arterna där visa samma utbredningsmönster som i Sverige. Sålunda föreligger *Dr. assimilis* från alla delar av Norge och Finland, från längst i söder till högst upp i norr. I Finland har också dess kromosomtal fastställts å material från Helsingfors-trakten (V. SORSA 1958 som *Dr. austriaca=dilatata*). Dess sporer (sannolikt från nordöstra Finland men tyvärr utan angiven proveniens) ha otvetydigt avbildats och beskrivits under namnet »*Dr. dilatata* s. lat.» av P. SORSA (1964), vilken även funnit fossila sådana sporer i Kuusamo (Salla) från senare delen av atlantisk tid (AT2=4700—2000 f.Kr.). (P. SORSA 1965 p. 374) — *Dr. dilatata* har jag däremot sett endast från Syd- och Västnorge (Oslo-trakten, Vest-Agder, Hordaland samt Sogn

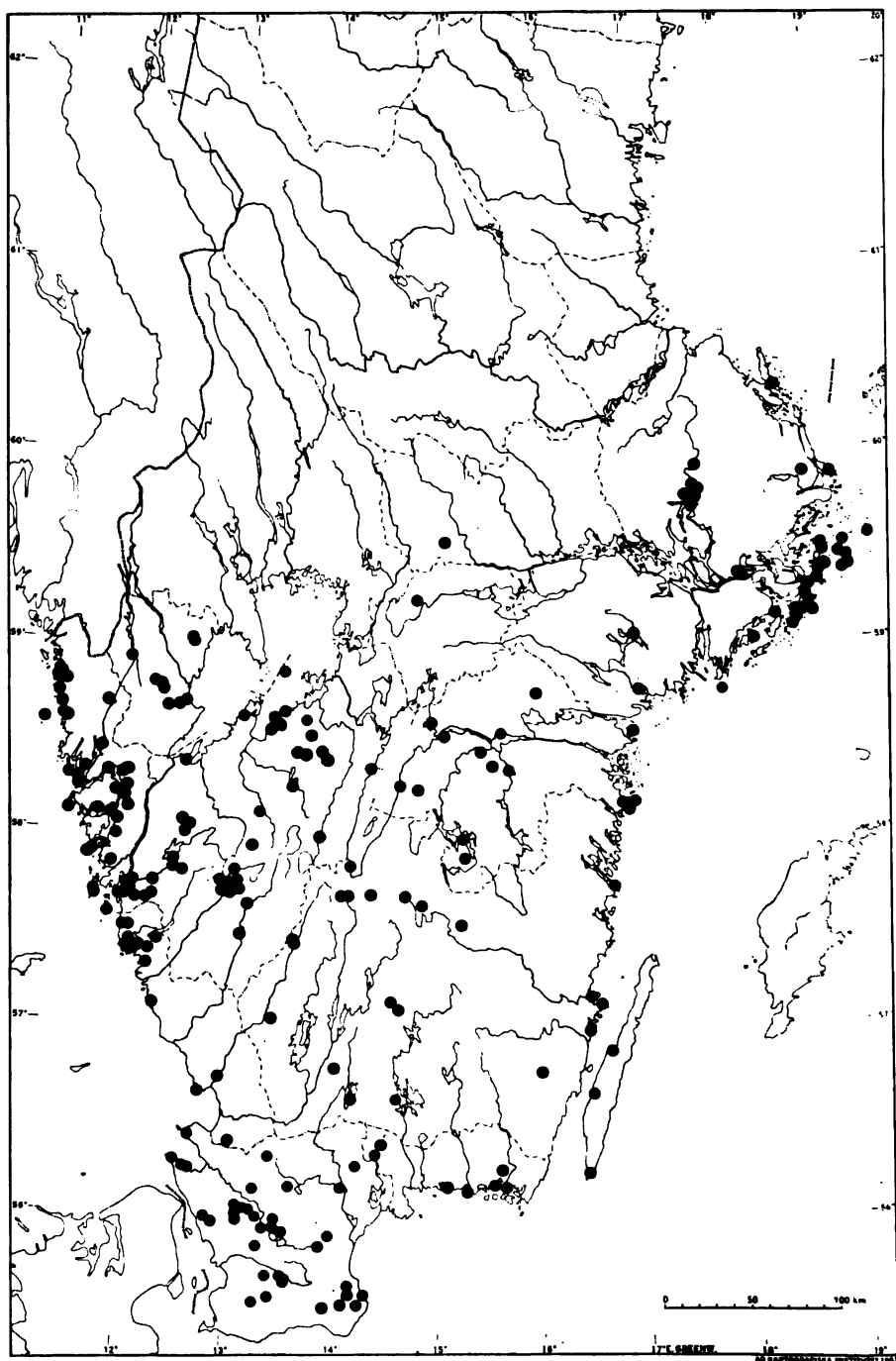


Fig. 2. Totalutbredningen av *Dr. dilatata* i Sverige. — The total distribution of *Dr. dilatata* in Sweden.

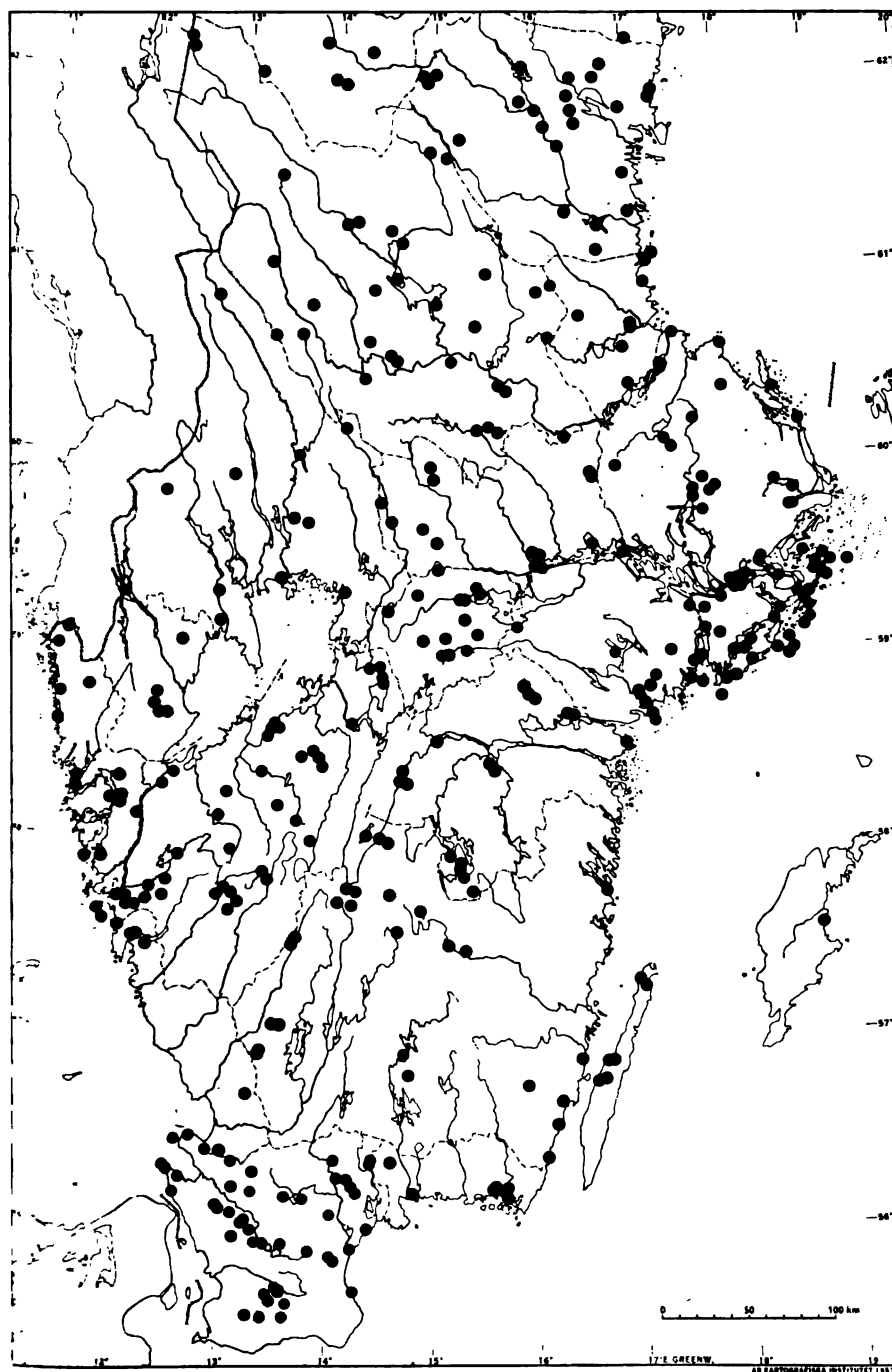


Fig 3. Utbredningen av *Dr. assimilis* i Syd- och Mellansverige. — The distribution of *Dr. assimilis* in south and central Sweden.

og Fjordane) och från sydligaste Finland (Åland och Nyland). — Från skilda delar av Danmark föreligga bägge arterna. Från Färöarna har jag sett blott *Dr. dilatata*. Det isländska materialet är bristfälligt, dock finns däri med säkerhet *Dr. dilatata*, möjligen även *Dr. assimilis*. LÖVE & LÖVE (1961) ha publicerat kromosomtalet  $2n=164$ , alltså *Dr. dilatata*, från sydvästra och norra Island.

De bägge arternas totalutbredningar äro ännu mycket svårbedömbara. I Storbritannien och Irland är *Dr. dilatata* utbredd över hela landet, under det att *Dr. assimilis* ända tills helt nyligen varit känd blott från typlokalen (Ben Lawers). Nu ha emellertid herbarie-exemplar från ett antal lokaler i Skottland och norra England kunnat identifieras med denna (WALKER & JERMY 1964). — På det europeiska fastlandet förefaller också *Dr. dilatata* att vara den dominerande arten, åtminstone västerut. *Dr. assimilis* har hittills blott publicerats från några lokaler i Alpkedjan, där bestämningarna kunnat verifieras med kromosomräkningar. Det herbariematerial jag sett tyder emellertid på att arten är allmän i Alporna och härutöver har en vidsträckt eurasiatisk utbredning. Det förefaller ej osannolikt, att *Dr. dilatata* kommer att visa sig inskränkt till Väst- och Mellaneuropa. — I Nordamerika förekomma en tetraploid och åtminstone två diploider av intresse i detta sammanhang (WALKER 1961). Tetraploiden, *Dr. campyloptera* (Kze) Clarkson, även känd som *Dr. dilatata* subsp. *americana* (Fisch.) Hultén, förekommer i Öststaterna och står morfologiskt nära såväl *Dr. dilatata* som *Dr. assimilis*. Den ena diploiden är den inledningsvis omnämnda *Dr. intermedia*, likaledes hemmahörande i Öststaterna. Den andra växer däremot i pacifika Nordamerika och överensstämmer morfologiskt mycket nära med *Dr. assimilis*, ehuru WALKER ej anser tiden mogen att förena dem. Hans fortsatta studier över hela detta komplex motses med största intresse. Med föreliggande uppsats har jag blott velat visa möjligheten att genom herbariestudier fastställa arternas utbredning inom ett enskilt land.

## Summary

### *Dryopteris dilatata* and *Dr. assimilis* in Sweden

The author has found it possible to establish the main features of the distributions of these ferns in Sweden by means of the material preserved in the Swedish public herbaria. The most reliable morphological characters are the colour and structure of the perispore, but the shape and structure of the frond and of the scales may also be useful for the determination, although both species are highly variable in these respects. — *Dr. assimilis* is distributed

all over Sweden and ascends into the reg. alp. *Dr. dilatata* is restricted to the southern parts, not reaching the north limit of the oak. Moreover, it shows a marked concentration towards the west and a decided predilection for the outer skerries in the Baltic. — The first recognizable record of *Dr. assimilis* from Sweden dates back to 1792. No Swedish reports of *Dr. dilatata* × *spinulosa* are reliable, most refer to *Dr. assimilis*. The hybrids *Dr. assimilis* × *dilatata* and *Dr. assimilis* × *spinulosa* have not been found in Sweden as yet but should be sought for. — The area of *Dr. assimilis* covers also the whole of Finland and Norway, whereas *Dr. dilatata* has been seen only from southernmost Finland (Åland and Nyland) and southern and western Norway (the Oslo region and the west coast). In Denmark both species seem to be distributed widely. *Dr. dilatata* has been seen also from the Faeröes and Iceland.

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## Noen gaeliske bidrag til oppklaring av hva trenavnet alm betyr

Av ROLF NORDHAGEN

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I min avhandling »Om barkebrød og treslaget *alm* i kulturhistorisk belysning» (1954) har jeg i tilslutning til mine undersøkelser over almebarkens merkelige innhold av slimceller og innerbarkens bruk til barkebrød og »seiga» i brøddeig, prøvd å etymologisere *alm*. Til *alm* står gammel-høytysk, mellom-høytysk og angelsaksisk *ēlm* i avlydsforhold. Angelsaksisk hadde dessuten *ulm-tréow* og mellom-høytysk *ulmboum* (i moderne tysk: *Ulme*). Enkelte forskere har antatt at disse vestgermanske former med vokalen *u* er influert av latin *ulmus*; men i nyere etymologiske ordbøker betraktes vestgermansk *ulm(e)* som genuint. I germanske språk har altså trenavnet 3 vokaltrin.

Romernes navn på almetrærne var *ulmus*. Fra keltiske språk er kjent det mellom-irske *lem*. I slaviske språk finner man *ilma*, *ilm* o. fl. former; men dette er lånord fra tysk, hvor treet i visse dialekter heter *llme*, *llmbaum*.

Ifølge FALK og TORP (1903—1906) og WALDE-POKORNY's håndbok (1927) hører de nevnte germanske, italiske og keltiske ord nøye sammen:

1) Latin *ulmus* føres tilbake til et indoeuropeisk *\*l-mos*. Samme avlydstrin (nulltrinet, svakstadiet) foreligger i mellom-irsk *lem*. Sammen med dette stiller WALDE-POKORNY gallisk *Lemo-*, *Limo-* i franske stedsnavn.

2) Gammel-høytysk *ēlmboum* og angelsaksisk *ēlm* (engelsk *elm*) antas å innebære avlydstrinet *\*el*, altså *\*ēl-mos*.

3) Gammelnorsk *almr* (av *\*almar*) antas å gå tilbake på indoeuropeisk *\*ol-mos*, det vil si avlydstrinet *\*ol-*.

4) Det mellom-høytyske *ulmboum* og det angelsaksiske *ulm-tréow* antas å innebære avlydstrinet *\*ul-* (indoeuropeisk *l-*; se under punkt 1 ovenfor).



Ifølge WALDE-POKORNY er alm-navnene bygd over en rot indoeur. *ēl- : ol- : l*, som i germansk ga *el- : al- : ul-*. Bortsett fra at enkelte forskere antar at navnekretsen kanskje er beslektet med den som utmerker *or* eller *older*, dansk *el*, svensk *al*, latinsk *alnus*, noe som er høyst tvilsomt, hadde jeg inntil 1954 ikke kunnet finne noe forsøk til en tydning av *alm*, *ēlm*, *ulmus*, *lem*.

Det virkelig originale og oppsiktsvekkende ved slekten *alm* og dens arter, både i Den gamle og Den nye verden, er barken og dens anvendelse. Her kan nevnes at den slimrike og adstringerende almebarken helt fra oldtiden av har vært brukt til å legge på sår og byller. PLINIUS MAJOR må antas å ha hatt kjennskap til slimbarken; han taler nemlig om »den tåreaktige substans som kommer fra treet» og om »den fuktighet som flyter ut av marginen på et beskåret tre» (se ellers NORDHAGEN 1954 s. 296—298).

Det kunne i og for seg være fristende å stille trenavnet sammen med latin *Alma*, et kvinnenavn, som igjen oppfattes som en avledning til det latinske adjektiv *almus* »huld, nærende», til verbet *alere* »nære, fostre, oppale». Dette verbum gjenfinnes i nordiske språk som *ala*, *ale*, *oppale*. Men ifølge avdøde professor C. J. MARSTRANDER, Oslo, består vanskeligheten deri at *ale* har førgermansk *a*, noe som latin *alere* og irsk *alid* viser, og et førgermansk *a* skifter bare rent unntaksvis med *o*. Alt i alt, uttaler MARSTRANDER (in litteris), må det anses for lite sannsynlig at *alm*, *ēlm*, *ulmus*, *lem* har noe med *al-* i *alere* og *ale* å gjøre.

I 1954 gjorde jeg oppmerksom på et tydningsalternativ som meg bekjent aldri hadde vært tatt opp til overveielse: man har i indoeuropeiske språk faktisk en språkrot eller et tema *el-* med avlyds-trinnene *ol-* og *l-* som finnes i en lang rekke orddannelser — såvel substantiver og adjektiver som verber — som angår slimete, sleipe, stundom uappetittlige ting. Som eksempler nevner jeg i min avhandling det norske substantiv *ulka* f. »vedhengende slim, slam etter flom, ekkel bløt masse, myggel». Videre dyrenavnet *ulk* m. og *ulka* f. = fisken marulk, og det telemarkske *ulka* f. »padde». Disse dyrene har en sleip, slimet hud. Plattysk har *Ulk* »frosk». Norske dialekter har verbet *alka* »søle, grise». Jysk har verbet *alke* »elte med besvær i noe». Verbet *ulma* i norske dialekter betyr »å bli utskjemt» (om matvarer). Jysk har *olm* »myglet» og østfrisisk har bl.a. verbet *ulmen* »råtne, oppløses».

Alle disse ord refereres av WALDE-POKORNY og FALK og TORP til den ovenfor nevnte indoeuropeiske rot *el-* med avlydsstrin. På en forespørsel fra meg om trenavnene *ēlm*, *alm*, *ulmus* kan forbindes med roten

*el-:ol-:l* i de ovenfor nevnte orddannelser, svarte professor MARSTRANDER meg at dette er mulig. Språklig sett er det ikke noe i veien for å jevnføre det norrøne *almr* med f. eks. det norske verbum *ulma*. Med andre ord: formelt språklig er det intet i veien for å tyde trenavnet *alm* henholdsvis *ēlm*, *ulmus* og *lem* som »det slimavgivende» eller »det sleipe tre», siktende til barkens egenskaper.

Jeg har i mange år prøvd å finne en støtte for denne min tydning også i keltiske språk. Under en lang reise i Storbritannia i 1956 endte jeg i Lerwick på Shetland. Desværre hadde jeg tåke og regn nesten hver eneste dag i den tiden jeg var på Shetland. Men i Lerwick fant jeg et førsteklases folkebibliotek med mange interessante bøker, bl.a. JOHN CAMERON »The Gaelic Names of Plants (Scottish, Irish, and Manx). New and revised Edition» (Glasgow 1900). Første utgave av denne bok hadde jeg tidligere studert, men den nye utgave hadde Universitetsbiblioteket i Oslo ikke.

Jeg fant i denne utgaven en rekke høyst interessante opplysninger om keltiske *Ulmus*-navn. Her nevnes fra gælisk og irsk *liobhan*, fra manx *lhionon*. CAMERON refererer disse navn til adjektivet *liobh* »smooth, slippery». Han skriver videre: »And the tree in Gaelic poetry is associated with, or symbolic of, slipperiness of character, indecision. Cecily Macdonald, who lived in the reign of Charles II (1660—1685), describing her chief, wrote as follows (her følger 8 keltiske linjer, som CAMERON oversetter til engelsk på følgende måte):

“Thou wast the yew from the wood,  
thou wast the firm strong oak,  
thou wast the holly and the thorn,  
thou wast the rough, pleasant apple,  
thou had'st not a twig of the aspen,  
under no obligation to the alder,  
and had'st no friendship with the elm.  
Thou wast the beloved of the fair”

Denne sammenligning mellom kongens karakter og en lang rekke treslag, er overordentlig interessant. Først kommer de egenskaper som forfatterinnen setter høyt: *Yew* (*Taxus baccata*, norsk barlind, g.norsk ýr) er jo kjent for sin motstandsdyktige og seige ved. *Oak* (norsk og svensk ek~eik) regnes jo for å være det sterkeste av alle treslag. Dette gjelder både *Quercus robur* og *Q. petraea* (*Q. pedunculata*). *Holly* (*Ilex aquifolium*, norsk kristtorn, i dialekter beinved) er kjent for sin hårde ved: ellers er jo bladene, som har tornet rand og som derfor er stikende, mest påfallende.

Hva forfatterinnen egentlig vil symbolisere med strofen ›thou wast the rough, pleasant apple›, kan jeg ikke si med sikkerhet; men villapal (*Malus silvestris*) har kraftige vedtorner, og passer godt i selskap med kristtorn, dessutom har den en hård og varig ved.

Så kommer 3 ›negative›, ja man kan vel si nedsettende-symbolske, men i virkeligheten flatterende bilder: 1) ›Thou had'st not a twig of the aspen›. Asp eller osp (*Populus tremula*) har jo blad som skjelver for det minste vindpust, og kan meget vel symbolisere svakhet, vankelmodighet, mangel på karakterstyrke. 2) ›under no obligation to the alder›. Denne strofen er ikke så lett å bli klok på. Den alder forfatterinnen sikter til, må være svartor (*Alnus glutinosa*), den eneste ore-art som er viltvoksende i Storbritannia. Om svartor skriver F. C. SCHÜBELER i ›Viridarium Norvegicum› (1886, bd. I, s. 487): ›Efter et, som det synes, i Tyskland almindeligt Sagn skal Manden være dannet af Ask (*Fraxinus*), Kvinden af Or (*Alnus*). . . . I det hele taget er Træet ikke synderligt i Anseelse, og man har endog et Ordsprog som siger: ›Erlenholz und rothes Haar sind auf gutem Grunde rar.› Ord-taket er inspirert av det faktum at *Alnus glutinosa* oftest vokser på dårlig, vannsyk mark. Sannsynligheten taler for at ringeakten overfor *Alnus* også har vært utbredt i folketroen i Storbritannia.

Så kommer den merkeligste strofen: 3) ›and had'st no friendship with the elm›. Hvis ikke CAMERON, like før han gjengir CECILY MACDONALD's lovprisning, hadde skrevet at i gælisk poesi er almetreet (the elm) et symbol på ›slipperiness of character, indecision›, ville strofen ha forvirret meg i høyeste grad. I min avhandling av 1954 har jeg jo vist at *Ulmus*-artene over store deler av Europa og helt tilbake til oldtiden har vært betraktet som særlig verdifulle, både for mennesket og dets husdyr. Den alme-art som CECILY MACDONALD har hatt i tankene, må utvilsomt være den samme art som vi har i Norge, nemlig *Ulmus glabra* (tidligere ofte kalt *U. scabra*). Hvorvidt forfatterinnen med egne øyne har sett at avflådde barkstrimler av alm blir sleipe dersom de utsettes for fuktighet, er usikkert; kanskje har hun bare kjent den symbolikk som i gælisk poesi er knyttet til almen.

Hvorvidt almebark har vært brukt til barkebrød i nødstider i Skottland og Nord-England, vet vi ikke; men BRITTEN & HOLLAND (1876—1886) opplyser at barn og ungdom i Northumberland og i strøket mellom Durham og Berwick kaller almen for *chew-bark*. De skjærer biter av innerbarken om våren og tygger på dem på grunn av ›a certain clamminess› som utmerker innerbarken. Samme bruk av barken som et primitivt nytelsesmiddel er kjent fra Vestlandet i Norge (jfr. NORD-

HAGEN 1954 s. 291). Kjennskapet til almens sleipe innerbark synes å være gammelt både i Norge og i visse strøk av Storbritannia.

Av CAMERON's fremstilling synes det å fremgå at han også kjenner andre eksempler fra gælisk poesi enn CECILY MACDONALD's 300 år gamle lovprisning på at *elm* har vært symbol på »slipperiness of character, indecision». For en som ikke behersker gælisk, er det beklagelig at CAMERON's fremstilling er så kortfattet.

Mitt opphold på det tåkefulle Shetland sommeren 1956 ga, takket være CAMERON's bok, en helt uventet støtte for mitt tidligere forsøk på å etymologisere *ēlm*, *alm*, *ulmus*.

Med dette lille botanisk-filologiske bidrag har jeg villet bringe professor dr. TYCHO NORLINDH en hyldest, ikke minst fordi han våren 1961 påtok seg å være fører på Öland for en skare norske studenter med meg som leder. Takket være NORLINDH fikk jeg for første gang i mitt liv se viltvoksende *Ulmus carpinifolia* og *U. laevis*. Av spesiell interesse for meg var det å kunne flå av et lite barkstykke på et tre år gammeldt skudd av *U. campestris* og senere legge det i vann på Vickleby Pensionat. Innerbarken viste seg å være enda rikere på slim enn et barkstykke av *U. glabra* som jeg hadde tatt med till sammenligning, et forhold som også fremheves i farmakologisk litteratur.

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## Cape “Fynbos” Today

By ELSIE ESTERHUYSEN

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Since the *Flora Capensis*, overseas botanists have continued to make their contribution of revision work. More recently, the publications of WEIMARCK on *Cliffortia* and *Aristea*, WHITE and SLOANE on *Stapelieae* and the succulent *Euphorbieae*, WIMMER on *Lobelioideae*, NORLINDH on *Calenduleae* and DAHLGREN on *Aspalathus* have been of major importance.

In South Africa we particularly appreciate the thoughtful consideration of the botanist who chooses to place a holotype in a S. African herbarium, rather than in one in his own country. When we have an isotype, this may be said to be of trifling interest, but it can be a real boon. However thorough a revision may be, it seems that the chances are that there will be room for further work. Certainly, this applies in the S.W. Cape where “*Ex Africa semper aliquid novi*” is still the case.

We appreciate, also, a generous distribution of duplicates. When a species from our region has been newly described, it is most irksome when this results in one more gap appearing in the collection, and a repetition of the old pattern of S. A. plants buried in European herbaria. A “lost” species, of which there are all too many, is welcomed like the Prodigal Son, of course, and, when an expedition has succeeded in tracking down one, it would be a relief to know that material would be distributed all round. It is becoming painfully evident that in more and more extensive areas the Cape “fynbos” is being wiped out. Besides the usual encroachment by man, exotic trees and shrubs, Wattles, Pines and *Hakea* chiefly, are taking over, their rapid spread being promoted by fire. So that, eventually, not only species, other than those suitable for cultivation, will be lost, but also the range in variation, essential for taxonomy. Plant collecting has changed in character within the

last few decades. Whereas formerly there were exciting finds to be made in remote and inaccessible places, improved roads and transport have altered this, until now the excitement is to be found in snatching plants from the path of the bulldozer, and difficulties, in attempting to penetrate where *Hakea* has covered a slope. Work is still retarded, however, by the lack of funds and personnel. Although in recent years the government has made more provision for this, it is still far from adequate to deal with our problems, the "fynbos" being, possibly, unique in its richness.

The collection and classification of much of our flora is becoming a struggle against time, without much chance of winning. The outlook would be more depressing had we time to dwell on the catastrophe, but there is too much to be done, in every line, with opportunities waiting around every corner. In spite of all the attention given to the Flora of the Cape Peninsula, for instance, in 1949 the original collecting of *Centella caespitosa* Adamson was made by GARSIDE, on the "Summit of Table Mt., Western Table", along the path trodden, at some time or another, during the past century or two, by just about every botanist in the Cape, resident or visiting, who most probably walked over this distinct species. The state of the South African *Restionaceae* provides another example of this richness of opportunity. Of the 289 species, recognised or described by PILLANS, 63 of these were represented by the type collecting only, and at the present moment in the Bolus Herbarium, 39 of them still are represented by the single collecting. Material beginning to come in now, however, is disproving any idea of there being such a high proportion of local endemics in the family. Too often it is not possible to be sure, from our records, whether a species is absent from an area, unless conditions are known to be adverse, or to be able to state the limits of distribution of a species. *Disa marlothii*, for example, a rare plant, found on rocky stream-banks, was known from the Clanwilliam-Ceres-Worcester area only, until it turned up at the north base of the Zitzikamma Mts. in the Uniondale Div. Indeed, the limits of distribution of most of our less conspicuous plants may never be known with any degree of accuracy. This question may remain unanswered for the phytogeographer, unless an unforeseen spate of specialist-collectors should be able to comb the "fynbos" countryside, in the not too distant future.

## Pollenmorphologische Notizen über einige Blütenpflanzen *incertae sedis*

Von S. BORTENSCHLAGER, G. ERDTMAN und J. PRAGLOWSKI

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Neuerdings hat HUTCHINSON — ob mit Recht oder Unrecht? — einige neue Blütenpflanzenfamilien aufgestellt. In letzter Zeit sind ausserdem von anderen Autoren noch recht viele neue Familien aufgestellt oder vorgeschlagen worden, so z.B. in Kew Bulletin 19 (3):489, 1965 (CUTLER & AIRY SHAW) die Familien *Anarthriaceae* und *Ecdeiocoleaceae* und in Kew Bulletin 18 (2):249, 1965 (AIRY SHAW) die Familien *Alseuosmiaceae*, *Androstachydaceae*, *Bischofiaceae*, *Blepharocaryaceae*, *Canotiaceae*, *Carlemanniaceae*, *Cleomaceae*, *Dicrastylidaceae* (*Chloanthaceae*), *Emblingiaceae*, *Flindersiaceae*, *Foetidiaceae*, *Goetzeaceae*, *Hanguanaceae*, *Hymenocardiaceae*, *Kingdoniaceae*, *Leonticaceae*, *Oncothecaceae*, *Paracryphiaceae*, *Plagiopteraceae*, *Sladeniaceae*, *Tetramelaceae*, *Tribelaceae*, *Triplotegiaceae* und *Uapacaceae*. Eine hauptsächlich pollenmorphologisch begründete Anregung zur Aufstellung von einigen dieser neuen Taxa höherer Ordnung wurde schon von ERDTMAN (Pollen Morphology and Plant Taxonomy I, 1952) gegeben; vgl. z.B. Seite 98 (*Alseuosmia*) und 180 (*Hanguana*). Die folgenden Zeilen bezwecken nur einige dieser neuen Taxa ganz kurz mit neueren pollenmorphologischen Daten zu beleuchten. Wir werden dabei aber lieber etwas zurückhaltender und kritischer mit der Aufstellung neuer Taxa sein, nur in einem Fall (*Centrolepidaceae*—*Diplanthereae*) scheint es uns möglich, dass man in Zukunft vielleicht besser von einer neuen Familie sprechen sollte.

### Bemerkungen zu den Restionales

*Centrolepidaceae* Desvaux 1828, *Restionaceae* R. Brown 1810, *Flagellariaceae* Dumortier 1829.

Wir verweisen hier auf ERDTMAN (1952) usw. sowie auf die umfassende Arbeit von CHANDA in *Grana palynologica*, Vol. 6: 3, 1966 (im Druck). Es zeigen diese Arbeiten klar, dass keine pollenmorphologischen Gründe für die Aufstellung von zwei neuen, zum Teil auf anatomische Merkmale begründete Familien, die *Ecdeiocolaceae* und die *Anarthriaceae*, bestehen. Statt dessen kann auf die ausgeprägte Ähnlichkeit des sehr speziell gebauten Porus von *Ecdeiocola* mit dem Porus der „graminoiden“ *Restionaceae*, der *Flagellariaceae* (*Hanguana* natürlich ausgenommen) und den *Gramineae* hingewiesen werden. Zwischen den *Restionales* und den *Commelinaceae* bestehen keine auffallenden pollenmorphologischen Ähnlichkeiten. Es sei hier erwähnt, dass die *Restionales* nur wenn man von den sehr ungenau bekannten *Centrolepidaceae*—*Diplanthereae* absieht eine „natürliche“ pollenmorphologische Reihe bilden.

Wegen Mangel an Material hat CHANDA die *Centrolepidaceae*—*Diplanthereae* nicht untersuchen können. Wir verdanken den Herren METCALFE (Kew), JOHNSON (Sydney) und MOAR (Christchurch) die Zusage von Material von *Hydatella inconspicua* aus Neu Seeland und von *Trithuria macranthera* aus West-Australien. Die Untersuchung dieses Materials hat folgendes ergeben.

Die Pollenkörner von *Hydatella inconspicua* (Taf. 1: 7—11) sind mehr oder minder unregelmässig, schwer zu beschreiben, bisweilen zu Tetraden vereinigt. Sie erinnern an keine Pollenkörner der *Restionales*. Über etwaige Ähnlichkeiten mit Pollenkörnern von anderen Pflanzen ausserhalb dieser Ordnung können wir uns nicht äussern. Die Pollenkörner von *Trithuria macranthera* (Taf. 1: 1—6) sind 1-colpat (wahrscheinlich anacolpat). Aus der Beschreibung (siehe unten) geht hervor, dass sie den Pollenkörnern der *Centrolepidaceae* ganz unähnlich sind. Vergleiche mit den Pollenkörnern mehrerer *Monocotyledonenfamilien* ergaben keine Anhaltspunkte zur näheren Festlegung der mutmasslichen systematischen Stellung dieser Pflanzen. Vielleicht handelt es sich um Vertreter einer neuen Familie. Für die Aufstellung einer neuen Familie ist aber natürlich eine gründliche, allseitige taxonomische Bearbeitung notwendig.



## Pollenbeschreibungen

*Hydatella inconspicua* Cheesem. (New Zealand, Lake Waiparera, north of Kaitaia, Northland, 10.1.1966 E. W. E. BUTCHER): Körner bis  $22 \times 26 \mu$  gross, öfters in Tetraden vereinigt, Aperturen unklar, ev. 1-porat mit Operculum oder Apertur als Colpus aufspringend. Exine pertectat ?, rauh; Tectum ca.  $0,3 \mu$  dick, infractale Bacula rund, ca.  $0,4 \mu$  Höhe ca.  $0,5 \mu$ ; Nexine ca.  $0,3 \mu$  dick.

„*Hydatella* sp.“ (*Trithuria macranthera*) (W-Australien, Midland Junction 1901 FITZGERALD s. n.): Körner einzeln, bilateral (ca.  $13,5 \times 20 \times 17 \mu$ ). Der Colpus erstreckt sich über die ganze Kornlänge, leicht klaffend. Exine am Colpusrand etwas eingebogen, nicht verdünnt, pertectat, ca.  $1,2 \mu$  dick. Tectum ca.  $0,3 \mu$  dick, infractale Bacula rund, ca.  $0,4 \mu$  Durchmesser und  $0,5 \mu$  hoch; Nexine ca.  $0,3-0,4 \mu$  dick.

## Über die Abgrenzung und Unterabteilungen der Diapensiaceen

In Kew Bulletin 17:3 (1964) hat AIRY SHAW vorgeschlagen, dass die Gattung *Diplarche* Hook.f. & Thoms. von den Ericaceen zu den Diapensiaceen übergeführt werden soll um dort einen eigenen Tribus, *Diplarcheae* (Klotzsch) Airy Shaw, zu bilden. Auf Grund einer Untersuchung von Präparaten der Sammlung des Palynologischen Laboratoriums in Solna, sowie von Material aus Kew, das uns von Herrn AIRY SHAW gütigst zu Verfügung gestellt wurde, gibt die Pollenmorphologie keinen Anlass *Diplarche* zu den Diapensiaceen zu überführen. Die Pollenkörner (Taf. 2:1—3) sind zu Tetraden vereinigt, die ganz denen der Ericaceen gleichen. Die Pollenkörner der (eigentlichen) Diapensiaceen, *Pyxidanthera*, *Diapensia* (Taf. 2:7—9), *Shortia*, *Schizocodon* (Taf. 2:4—6), *Berneuxia* und *Galax* (Taf. 2:10—13), sind hingegen nicht zu Tetraden vereinigt. Sie lassen sich in zwei morphologische Gruppen einordnen:

1. *Diapensia*-Gruppe: Pollenkörner colporat bis colporoidat, Sexine reticulat.
2. *Galax*-Gruppe (nur die Gattung *Galax*): Pollenkörner colpat, kleiner als in Gruppe 1, Sexine pertectat.

## Pollenbeschreibungen

*Diplarche*. — Pollen nach FISCHER's Regel in tetraedrischen Tetraden vereinigt, Einzelkörner 3-colpat, Exine leicht rauh.

*D. multiflora* Hook. f. & Thoms. (China, Mt. Fu-Chuan NW Yunnan, May—June 1928, ROCK 17033, S): Tetraden ca.  $43 \mu$  gross, Einzelkörner ca.  $28 \times 21 \mu$ . Distales Apocolpium ca.  $20 \mu$ ; Colpi ca.  $14 \mu$  lang; Sexine ca.  $1 \mu$  dick; Nexine ca.  $0,5 \mu$  dick.

*D. pauciflora* Hook. f. & Thoms. (SE Tibet, Tsarong Slawin-Kiuchiang Divide, July 1919, FORREST 18923, K): Tetraden ca. 39  $\mu$  gross, Einzelkörner ca. 24 $\times$ 18  $\mu$ . Distales Apocolpium ca. 17  $\mu$ ; Colpi ca. 23  $\mu$  lang; Sexine ca. 1  $\mu$  dick; Nexine ca. 0.5  $\mu$  dick.

*Diapensiaceae* s. str.

1. *Diapensia*-Gruppe. — Pollenkörner einzeln, 3-colporat bis 3-colporoidat, subprolat bis prolat. Apocolpia klein, Colpi am Äquator eingeschnürt. Ora nur im optischen Schnitt sichtbar. Exine reticulat, semitectat, gegen die Colpusränder hin dünner. Ebenso nimmt in dieser Richtung die Brochusgrösse etwas ab. Die Muri sind simplibaculat, die Bacula teils aber sehr undeutlich.

Herkunft der untersuchten Arten:

*Pygidanthera barbulata* Maxim.: USA New Jersey, 13.4.1939, WITTE s.n.; S.

*Diapensia himalaica* Hook. f. & Thoms.: Sikkim, Lachen alt. 3—4000 m, June 1849, HOOKER s. n. (Typus); K.

*D. lapponica* L.: Schweden, Jämtland 1907, PALM s.n.; S.

*D. purpurea* f. *albida* Diels: China, Yunnan, 1928, ROCK 17008; P.

*Shortia galacifolia* Gray; USA, South Carolina 1896 und 1918 (zwei Herkünfte); S.

*S. uniflora* var. *grandiflora* Maxim.: cult. H. B. Gothob. 26.3.1943, leg. ERDTMAN.

*Schizocodon ilicifolia* Maxim.: Japan, Hakone 7.6.1926; S.

*S. soldanelloides* S. & Z.: Japan, Mt. Hakkoda, JIMBO misit.

*Berneuxia thibetica* Decne.: China, Yunnan 1932, HU 52315; P.

*Zusammenstellung einiger Massangaben ( $\mu$ )*

	P	Ä	Apo.	Sex.	Nex.	Bac.	Muri	Lumina
<i>Pygidanthera barbulata</i>	28	21	4	1,2	0,6	0,5	0,6—0,8	0,8—1
<i>Diapensia himalaica</i>	31	25	6	1	0,5	0,4	0,6—0,8	0,8—1
<i>D. lapponica</i>	32	27	0—3	1,4	0,6	0,5	0,8—1	1,0—1,5
<i>D. purpurea</i>	36	30	5	1,2	0,5		0,6	0,6
<i>Shortia galacifolia</i>	35	28	6	1	0,6	0,4	0,6—0,8	0,8
<i>S. uniflora</i>	43	32	7	1,4	0,7	0,4	0,6—0,8	0,8
<i>Schizocodon ilicifolia</i>	33	24	8	1,2	0,6	0,5	0,6—0,8	0,8
<i>S. soldanelloides</i>	29	24	8	1,2	0,5	0,5	0,6—0,8	0,8—1,2
<i>Berneuxia thibetica</i>	29	25	4	1	0,5		0,8	0,8

2. *Galax*-Gruppe. — *Galax aphylla* L. (USA, Virginia 15.6.1872, CURTISS s.n.; S): Pollenkörner einzeln, 3-colpat (einzelne Körner syncolpat bis 4-colpat), prolat-sphaeroidal bis subprolat, ca 20 $\times$ 17  $\mu$ ; Apocolpium ca. 6  $\mu$ , Colpi am Äquator eingeschnürt. Exine pertectat, Tectum ca. 4,5  $\mu$  dick, glatt, infractale Bacula im Querschnitt rund (ca. 0,4  $\mu$ ), 0,7  $\mu$  hoch. Nexine ca. 0,5  $\mu$  dick.

### “Plagiopteraceae“

(Vgl. AIRY SHAW, Kew Bull. 18 (2): 266, 1965)

Material vom kletternden Strauch *Plagiopteron fragrans* Griff. („*P. suaveolens* Griff.“) wurde wahrscheinlich nur einmal im südlichen Burma (Tenasserim) von GRIFFITH eingesammelt. Über dessen mutmassliche systematische Stellung sollen hier keine Spekulationen angestellt werden. Mit den Pollenkörnern folgender von AIRY SHAW genannten Taxa, *Combretaceae*, *Dilleniaceae* (*Tetracera*), *Elaeocarpaceae*, *Flacourtiaceae*(?), *Malpighiaceae*(?), *Sapindaceae*, „*Stilaginaceae*“ (*Antidesma*), *Symphoremataceae* (*Symphorema*), *Tiliaceae*(?) und *Verbenaceae*—*Caryopteridoideae*, liegen wohl keine ausgesprochenen Ähnlichkeiten vor.

*Plagiopteron fragrans* Griff. (sub. nom. „*P. suaveolens* Griff.“, Galathea Expedition 1845—47, No. 1995, Herb. WALLICH, C). — Pollenkörner 3-colporat, pleurotrem, subprolat bis prolat, ca.  $30 \times 23 \mu$ . Amb mit abgerundeten Ecken (vgl. Taf. 3: 4). Apocolpium ca.  $4 \mu$ ; Furchen etwa  $25 \mu$  lang mit dünnen Kanten. Ora deutlich, Durchmesser ca.  $4,5 \mu$ , bisweilen mit seitlichen, äquatorialen oder etwas schiefen, schmalen, rissartigen Verlängerungen (Taf. 3: 2). Exine pertectat, dick, ca.  $3,2 \mu$ , Tectum etwa  $0,6 \mu$  dick, glatt, von ca.  $1,3 \mu$  langen infratectalen Becula gestützt. Nexine ca.  $1,3 \mu$  dick.

### “Blepharocaryaceae“

(Vgl. AIRY SHAW, Kew Bull. 18 (2): 254, 1965)

Die Gattung *Blepharocarya* F. Muell. mit zwei Arten, grosse Bäume aus Nord-Australien und Queensland, wurde von F. MUELLER zu den *Sapindaceae*—*Dobineae* gestellt, von ENGLER dagegen zu den *Anacardiaceae*—*Rhoideae*. BAILEY (Queensl. Fl. 1: 286, 1899) stellte sie zu den *Sapindaceae*—*Acerinaceae*.

Pollenmorphologisch hat *Blepharocarya* (vgl. Taf. 3: 5—10) nichts mit der auch pollenmorphologisch sehr gut gekennzeichneten Familie der *Podoonaceae* („*Dobineaceae*“; vgl. Kew Bull. 4 (1953): 555, 1954) gemeinsam. Auch die *Aceraceen* (*Acer*, *Dipteronia*) haben abweichende Pollenkörner. Mit Pollenkörnern vom *Rhus*-Typus (*Anacardiaceae*—*Rhoideae*) besteht jedoch eine ziemlich ausgeprägte Ähnlichkeit in Hinsicht auf Aperturen, Grösse und Exineaufbau.

*Blepharocarya involucrigera* F. Muell. (Queensland, F. MUELLER s.n., K). — Pollenkörner 3-colporat, peritrem, subprolat bis prolat, ca.  $21 \times 18$  bis  $30 \times 21 \mu$ . Apocolpia ca.  $5 \mu$ ; Colpi äquatorial etwas eingeschnürt; Ora deut-

lich, ca.  $3 \times 8 \mu$ , polwärts von deutlichen Nexineverstärkungen begrenzt. Exine etwa  $2 \mu$ , Sexine etwa  $1,3 \mu$ , Ectosexine etwa  $0,7 \mu$  dick, fein striat. Lirae mehr oder weniger meridional (Taf. 3: 8), schief (Taf. 3: 5), oder etwas unregelmässig verlaufend. In den Apocolpien und den benachbarten Teilen der Mesocolpien stehen die Lirae durch kleine Querleisten mit einander in Verbindung. Zwischen letzteren befinden sich lumen- oder punctum-ähnliche Löcher. Die Endosexine besteht aus feinen Bacula, Länge ca.  $0,6 \mu$ . Die Nexine ist ungefähr gleich dick wie die Endosexine.

\*

## Zusätze

Von G. ERDTMAN

### Caprifoliaceae, Carlemanniaceae

Vielleicht einer Vermutung BREMEKAMPS folgend hat WAGENITZ (ENGLER's Syllabus, 12. Aufl., 1965, Bd. II, S. 474) die Gattungen *Carlemannia* und *Silvianthus* von den Rubiaceen zu den Caprifoliaceen neben *Diervilla* und *Weigela*, Tribus *Diervilleae*, gestellt. AIRY SHAW (Kew Bull. 19(3): 507, 1965) erhebt sie dagegen zu einer besonderen Familie, den *Carlemanniaceae*, die teilweise einige Ähnlichkeiten — zwar nicht pollenmorphologisch (ERDTMAN) — mit gewissen Verbenaceen aufweisen sollen. Ohne die Bedeutung der pollenmorphologischen Merkmale überschätzen zu wollen scheint es doch nicht richtig zu sein die genannten Gattungen zu den Caprifoliaceen zu stellen (vgl. auch die vorsichtige Äusserung von Dr. R. C. METCALFE in Kew Bull. 19(3): 511, 1965). Leider hat WAGENITZ die in dieser Familie besonders gut ausgeprägten pollenmorphologischen Formengruppen bei der Einteilung der Familie nicht gebührend berücksichtigt (z.B. hat er die Gattung *Triosteum* bei den *Sambuceae* belassen). Die pollenmorphologischen Reihen sind wie folgt (ERDTMAN 1952, etwas erweitert):

*Lonicera*-Gruppe (diese Gruppe bildet den Kern oder — vielleicht besser — den einzigen Bestandteil der Familie): *Abelia* s.str., *Diervilla*, *Dipelta yunnanensis* (HANDEL-MAZZETTI 2158), *Heptacodium miconoides* (WILSON 2232; K), *Kolkwitzia amabilis*, *Leycesteria formosa*, *L. glaucophylla* (FORREST 9377; S), *Lonicera*, *Symphoricarpus*, *Triosteum* (vgl. WILKINSON in Amer. J. Bot. 36, 1949, und ERDTMAN 1952; *Triosteum* wurde auch von ENDLICHER 1841 und BENTHAM & HOOKER 1876 in die *Lonicereae* eingereiht), *Weigela*. Die Pollenkörner von *Zabelia* (früher zu *Abelia* s.l. gestellt) können in dieser Gruppe

eingereiht werden, obgleich sie in mancher Hinsicht, z.B. Fehlen von supratectalen Prozessen, abweichen. Pollenkörner vom *Zabelia*-Typus wurden schon von WALLICH in „*Plantae asiaticae rariores*“, Bd. I, London 1830, abgebildet. Obgleich *Zabelia* und die Gattung *Morina*, deren systematische Stellung umstritten ist, von einander habituell fundamental verschieden sind, wäre es vielleicht empfehlenswert wegen etlicher weniger Ähnlichkeiten die eigentümlichen, auffallend grossen Pollenkörner dieser Gattungen näher zu untersuchen und mit einander zu vergleichen (von *Morina* besonders diejenigen Arten, die der Untergattung *Acanthocalyx* angehören). In Solna konnte wegen Mangel an geeignetem Untersuchungsmaterial eine derartige Untersuchung noch nicht ausgeführt werden.

**Sambucus-Gruppe („Sambuceae“):** *Sambucus*, *Viburnum*, *Adoxa*. Die letzte Gattung wird meist — ob ganz berechtigt? — als eine besondere Familie, die *Adoxaceae*, geführt. BENTHAM und HOOKER stellten sie, zusammen mit *Sambucus* und *Viburnum* zu den *Caprifoliaceae*—*Sambuceae*.

**Alseuosmia-Gruppe (*Alseuosmiaceae* Airy Shaw in Kew Bull. 18 (2): 249, 1965):** *Alseuosmia*, *Memecylanthus*, *Periomphale* (*Pachydiscus*). Untersucht wurden die Pollenkörner von *Alseuosmia macrophylla* und *A. quercifolia* (ERDTMAN 1952), *Memecylanthus neocaledonicus* (DEPLANCHE 413, P; Pollenkörner 3-colporoidat, subprolat, etwa  $33 \times 26 \mu$ ), *Periomphale* (*Pachydiscus*) *gaultherioides* (SCHLECHTER 15426, G; Pollenkörner 3-colporat bis 3-colporoidat, etwa  $27 \times 27 \mu$ , an die von *Alseuosmia* erinnernd; Sexine dicker als Nexine, Apocolpien etwas verdickt, dort laufen sechs Arcus-ähnliche, die Colpi umgebende, verdickte Leisten zusammen). Beziehungen zwischen der *Sambucus*-Gruppe und gewissen Cornaceen sind hervorgehoben worden. Die Stellung der „*Alseuosmiaceen*“ ist unsicher.

Über die Pollenmorphologie der „*Carlemanniaceen*“ soll hier nur hinzugefügt werden, dass sie pollenmorphologisch am ehesten mit gewissen Rubiaceen übereinstimmen (ERDTMAN 1952, Fig. 224 G, S. 385). Untersucht wurden bis jetzt: *Carlemannia congesta* Hook.f. (5-colpat?, Diameter etwa  $47 \mu$ ), *C. griffithii* Benth. (5—6-colpat, suboblat bis oblat, etwa  $34 \times 45 \mu$ ), *Silvianthus bracteatus* Hook.f. (MEEBOLD 6270: 3-colpat, subprolat bis prolat, etwa  $26 \times 35 \mu$ ), *S. clerodendroides* Airy Shaw (type, KERR 21191, K; 3-colpat, Diameter etwa  $42 \mu$ ; Sexine wie bei *S. bracteatus* fein reticulat mit simplibaculaten Muri; Material von *S. clerodendroides* wurde gütigst von Herrn AIRY SHAW zu Verfügung gestellt).

### **Saxegothaea, Cohnia, Aegialitis, Allantospermum**

Die Gattung *Saxegothaea* könnte vielleicht besser von den Podocarpaceen zu den Araucariaceen übergeführt werden (ERDTMAN, Pollen Morph. & Pl. Tax., Bd. III, 1965, S. 73).

Die Pollenkörner von *Cohnia floribunda* Kunth (HOOKER s.n., Mauritius 1867; K) sind anacolpat, spinulos, zu kleinen Tetraden vereinigt (Diameter der Tetraden etwa 30  $\mu$ ). Diese Merkmale weisen zu den Liliaceae—Milliganieae (*Milligania*, *Astelia*, *Collospermum*) hin, nicht aber zu den Agavaceae—Draceneae oder Agavaceae—Cordylinae (*Cordylina floribunda* ist ein Synonym zu *Cohnia floribunda*).

Die eigentümliche, seltene Gattung *Aegialitis* wird von WAGENITZ (ENGLER's Syllabus 12 Aufl., Bd. II, 1965, S. 396) bei den *Plumbaginaceae*—*Staticeae* belassen. Bei den *Plumbaginaceae* s.l. finden sich zwei pollenmorphologisch sehr verschiedenartige Reihen; die eine umfasst die *Plumbagineae* („*Plumbaginaceae* s. str.“), die andere die *Staticeae* („*Armeriaceae*“). Aus pollenmorphologischen, aber auch aus gewissen anderen Gesichtspunkten scheint es darum kaum möglich *Aegialitis* bei den *Staticeae* („*Armeriaceae*“) zu belassen. Die Gattung passt viel besser zu den mehr oder minder linaceenähnlichen *Plumbaginaceae* s.str.

Als ein weiteres Beispiel für die Verwendbarkeiten pollenmorphologischer Merkmale bei der Festlegung der systematischen Stellung von *Plantae incertae sedis* kann noch folgendes kurz erwähnt werden. Aus Kew wurden vor einigen Jahren von Dr. FORMAN einige Antheren von „SAN A 4162“ aus Nord-Borneo nach Solna geschickt. Nach Untersuchung der Pollenkörner wurde die Vermutung ausgesprochen, es handle sich um eine *Ixonanthes*-ähnliche Art. Zuerst war Dr. FORMAN damit nicht ganz zufrieden, eher wollte er an die Familie oder Gruppe der Irvingiaceen (*Irvingioideae*) denken. Aber nachdem er fruchtendes Material erhalten hatte gab er diese Ansicht auf und beschrieb „SAN A 4162“ als *Allantospermum* Forman, gen. nov. und zwar als „*A. borneense* Forman sp. nov. adhuc unica“ und stellte sie zu den *Ixonanthaceae*—*Ixonanthoideae*.

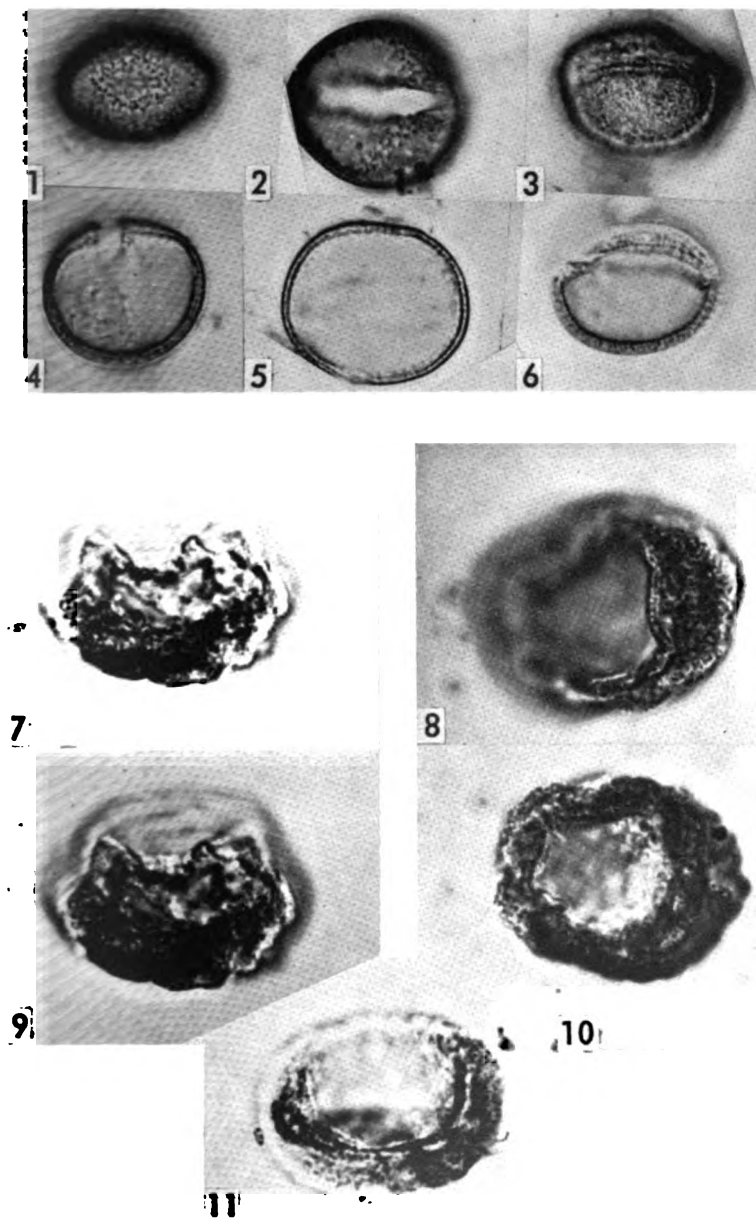
Eingehende monographische Darstellungen, die in Zusammenarbeit zwischen Pollenmorphologen und leitenden Systematikern ausgearbeitet werden, sind natürlich wertvoller als kurze Ährenlesen, wie sie hier vorgenommen wurden. Die pollen- und sporenmorphologische Forschung muss in grossem Umfang auf „service“ und „teamwork“, um einige bezeichnende englische Worte zu gebrauchen, bauen. In dieser Weise, den Richtlinien die in „Pollen Morpho-

logy and Plant Taxonomy, I—III, 1952—1965“ dargelegt worden sind folgend, bearbeitet man jetzt (oder hat schon bearbeitet) folgende Familien:

<i>Balsaminaceae</i> (Neuchâtel)	<i>Oxalidaceae</i> (Neuchâtel)
<i>Cucurbitaceae</i> (Concepción)	<i>Palmae</i> (Ibadan)
<i>Euphorbiaceae</i> (Humboldt-Universität, Berlin)	<i>Papaveraceae</i> ( <i>Meconopsis</i> ; Edinburgh)
<i>Gentianaceae</i> (Solna)	<i>Papaveraceae-Fumarioideae</i> (Chico, Cal.)
<i>Geraniaceae</i> und nahestehende Familien (Innsbruck)	<i>Plumbaginaceae</i> s.l. (Solna)
<i>Haloragidaceae</i> (Solna)	<i>Polemoniaceae</i> (Krakow)
<i>Iridaceae</i> und andere Monocotyledonenfamilien (Jena)	<i>Portulacaceae</i> (Lund)
<i>Linaceae</i> (Solna)	<i>Pteridophyta</i> (Solna, Helsinki, Lucknow)
<i>Loganiaceae</i> (Utrecht)	<i>Restionales</i> (Calcutta)
<i>Malvales</i> (Humboldt-Universität, Berlin)	<i>Rubiales</i> (St Louis)
	<i>Tropeolaceae</i> (Neuchâtel)

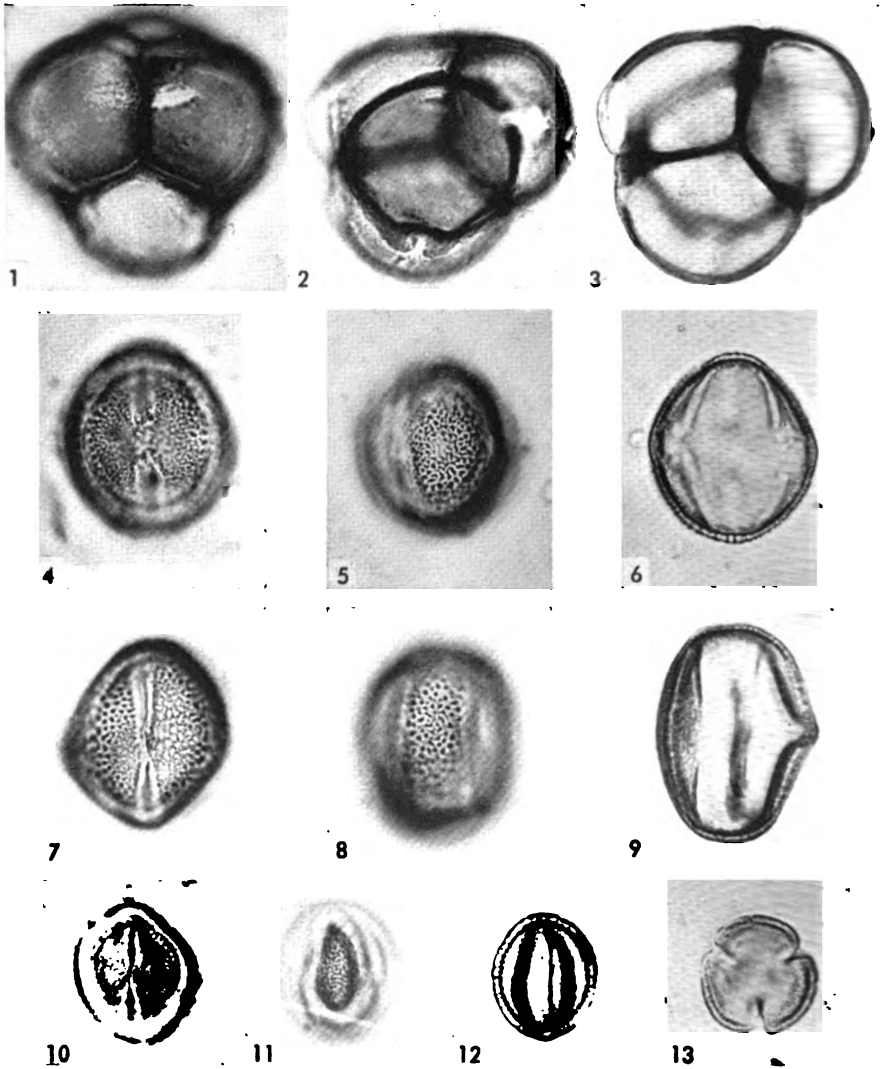
Nähere Auskünfte — um z.B. Doppelarbeit zu vermeiden — können vom Palynologischen Laboratorium, Solna, gegeben werden.

Diese kleine Mitteilung ist für die Festschrift, anlässlich des 60. Geburtstages von Prof. Dr. TYCHO NORLINDH bestimmt. Wir beglückwünschen Prof. NORLINDH zu dieser Gelegenheit und hoffen, dass die gute Zusammenarbeit zwischen dem Palynologischen Laboratorium und der Botanischen Sektion des Naturhistorischen Reichsmuseums zum Vorteil beider weiter bestehen wird.

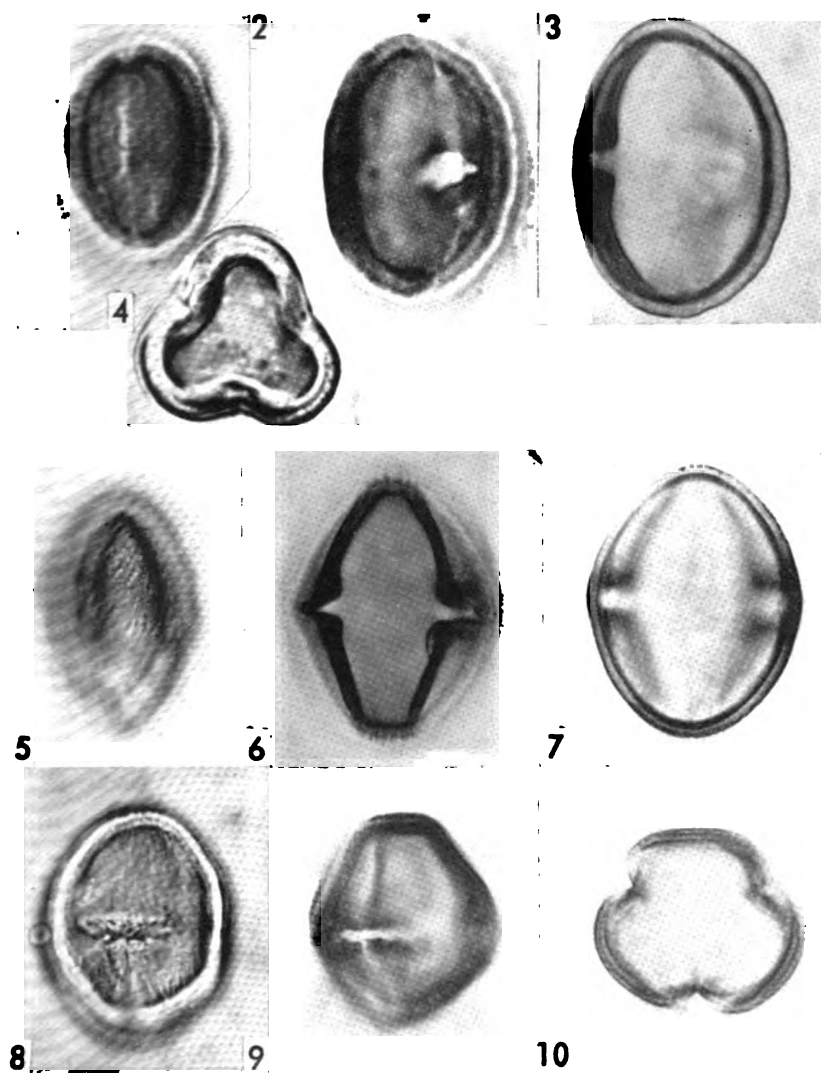


Taf. 1. — 1—6 *Trithuria macranthera* („*Hydatella* sp.“), 7—11 *Hydatella inconspicua*.  
—  $\times 1250$ .





Taf. 2. — 1—3 *Diplarche multiflora*, 4—6 *Schizocodon soldanelloides*, 7—9 *Diapensia himalaica*, 10—13 *Galax aphylla*. —  $\times 1000$ .



Taf. 3. — 1—4 *Plagiopteron fragrans*, 5—10 *Blepharocarya involucrigera*. —  $\times 1300$ .



## Den svenska aspens variation med hänsyn till bladformen

AV NILS SYLVÉN

Botaniska museet, Lund

I de svenska flororna möta i allmänhet relativt knapphändiga uppgifter om den varierande bladformen hos den vanliga svenska aspen. Den påfallande olikheten i bladform hos rotskotten och långskotten i förhållande till den hos kortskotten mötande bladtypen (se härom närmare »Några ord om aspens heterofylli» av NILS SYLVÉN, Sv. Bot. Tidskr. 1942, p. 373 ff.) är snart sagt den enda omnämnda bladformsvariationen. I »Skandinavians Flora» utgiven av OTTO R. HOLMBERG I b, häfte I (Stockholm 1931) lämnar dock BJÖRN FLODERUS en anmärkningsvärt fyllig beskrivning av bladen hos *Populus tremula* så lydande: »Blad fasta, till storlek (omkr. 3—7×3—8 cm.) och form mycket varierande: på kortskotten vanl. 3—6, gytttrade, cirkelrunda — rundat äggrunda, med bred, sällan något hjärtlik bas och avrundad l. trubbig spets, oregelbundet, glest och trubbigt bukttandade l. (säll.) näst. helbräddade, stråliskt 3-nerviga med starkare mittnerv, slutl. åtm. undertill upphöjt nätådriga, ovan gröna och vid fästet ofta glandelbärande, under något blekare gröna l. svagt blågröna, vanl. glatta; på långskotten talrikare, spridda, ej sällan med hinnlika, långa, smala, tidigt avfallande stipler, rombiska—trekantiga med avrundade hörn, i skottens övre del ± hjärtlika och spetsigare, med tätare, smärre, spetsigare, ofta glandelbräddade tänder, under vanl. håriga; unga blad tunna, ofta rödaktiga och silkeshåriga.» Bland särskilt namngivna former upptar han en f. *Freynei* Hervier: »Kortskottens blad ovala—triangulära—rombiska, med kilformig bas och tydlig spets (S. Vg. Toarp: A. O. Olson.)»

NILS HYLANDER har i »Lustgården» 1961 beskrivit och namngett »ett par säregna aspformer»: f. *paucidentata* Hyl. och f. *flabellata* Hyl.

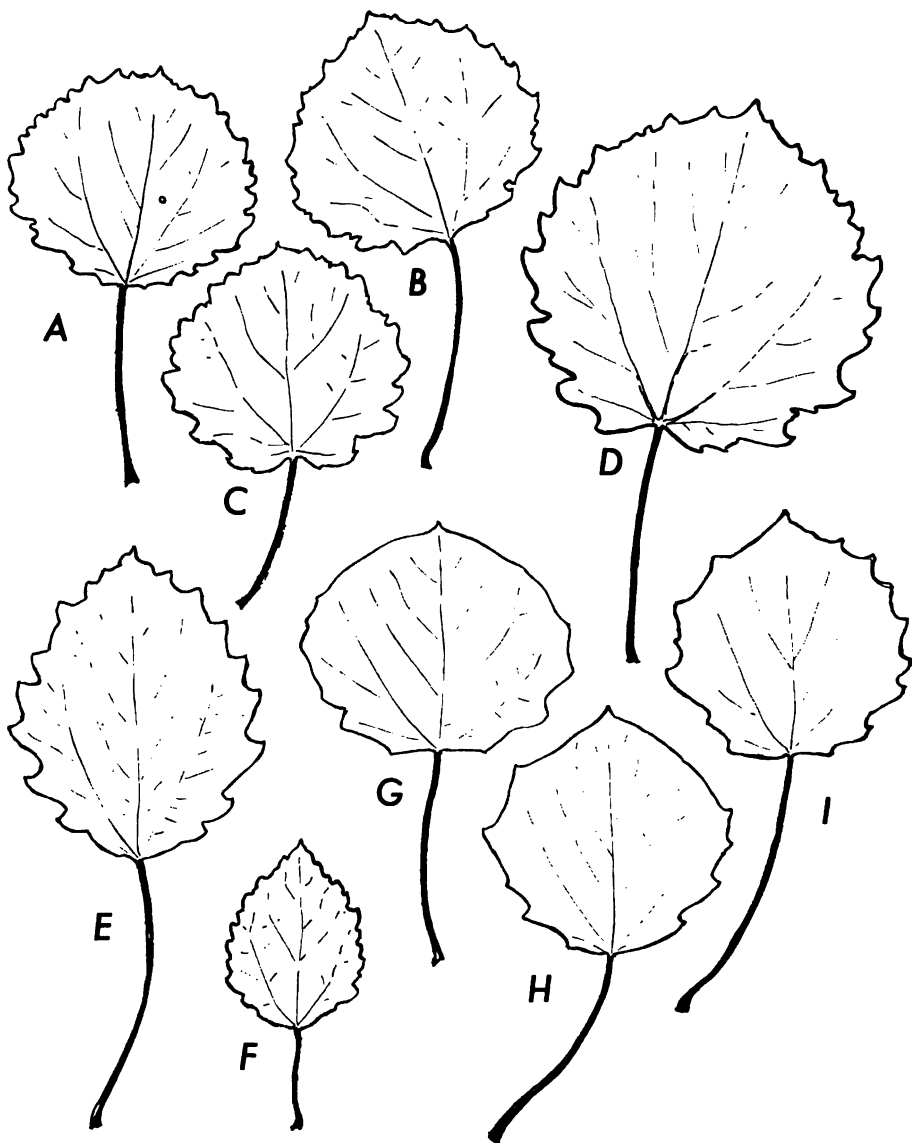


Fig. 1. *Populus tremula*: A kortskottsblad av relat. vanlig, cirkelrund form från Västerbotten, Vindeln 1937. B Kortskottsblad av rundad form med otandad bas och något utdragen spets från Norrbotten, Över-Luleå, Vittjärv 1937. C Kortskottsblad av rundad form med hjärtlik bas: f. *subcordata* n.f. från Västerbotten, Degerfors, Häggnäs 1937. D kortskottsblad av närmast samma form — f. *subcordata* n.f. — som föreg., från Norrbotten, Över-Luleå, Vittjärv 1937. E—F *P. tremula* f. *Freytii* Hervier. E från Hälsingland, Delsbo 1937, F från Skåne. Ängelholms havsbad 1956. G—H *P. tremula* f. *paucidentata* Hyl. G från Södermanland, Dunker, Björnedammen 1937, H från Södermanland, Länna, Norrälänna 1937. I *P. tremula* f. *ad formam paucidentata* Hyl. från Östergötland, Ringås 1937. — (Alla  $\times 1/2$ ).

Den förstnämnda av dessa är synbarligen identisk med den av FLODERUS ovan omnämnda formen med »nästan helbräddade» kortskottsblad, av honom betecknad som »säll.» förekommande bladform; från en enda fyndlokal har HYLANDER kunnat konstatera den vid genomgång av Botaniska museets i Uppsala herbarium, Skaftö i Bohuslän. Även den andra av HYLANDER namngivna formen, f. *flabellata*, har av honom angivits från en enda lokal i Botan. museets herbarium i Uppsala, nämligen Jämtland, Botåsen i Oviken; till denna form är väl dock även en av HYLANDER i »Lustgården» 1929 p. 191—192 omnämnd och avbildad aspform — »En egendomlig aspform» — från Skärblacka i Östergötland av avbildningen att döma närmast att hänföra.

Då Föreningen för växtförädling av skogsträd bildats 1936 blev såsom en följd av professor HERMAN NILSSON-EHLES fynd 1935 av jätteasp på Lillö i Bosjökloster (Skåne) aspen ett av de i växtförädlingsarbetet först upptagna skogsträden. Sommaren 1937 företog under-tecknad i samband med den påbörjade aspförädlingen en aspinventeringsresa från Skåne i söder till Norrbotten i norr för erhållande av närmare kännedom om aspens formväxling inom landet. En oväntat rik formväxling mötte härvid, ej minst beträffande de förut som relativt obetydligt varierande i allmänhet ansedda kortskottsbladen. Den vanligast mötande formtypen var den  $\pm$  cirkelrunda, oregelbundet och ofta täml. rikt bukttandade med  $\pm$  bred, ej inskuren bas och  $\pm$  starkt markerad spets (fig. 1 A—B). Rundade blad med  $\pm$  hjärtlik bas — f. *subcordata* n. f. (fig. 1 C—D) — antecknades 1937 från allenast 4 lokaler, Ög. Grebo, Vb. Degerfors (fig. 1 C), Nb. Över-Kalix, Vänsjärv, och Över-Luleå, Vittjärv (fig. 1 D); efter 1937 ha ett flertal nya fyndlokaler tillkommit från Halland (1 lokal), Småland (5 lokaler) och Östergötland: Skärkind, Skörtinge 1959 (INGA SYLVÉN); ansatser till hjärtlik bladbas ha dessutom antecknats från Ög. Åtvidaberg 1937, Dlr. Mockfjärd, Löfsen 1952, Gstr. Torsåker, Kratte Masugn 1958 och Ång. Ådalsliden, Sundmo 1948.

Den av BJÖRN FLODERUS upptagna f. *Freynii* Hervier med ovala—rombiska kortskottsblad anträffades under inventeringsresan 1937 i synnerligen vackert utbildad form i Hälsingland, Delsbo (fig. 1 E) och har senare av mig antecknats från ytterligare ett 20-tal nya lokaler från Skåne (5 lokaler; fig. 1 F), Västergötland (5), Småland (2), Dalsland (1), Uppland (2), Värmland (2), Dalarna (2) och Gestríkland (1 lokal); aspar med  $\pm$  *Freynii*-liknande kortskottsblad ha dessutom anträffats i Halland (2 lokaler), Småland (2), Öland (1) och Södermanland (1 lokal).

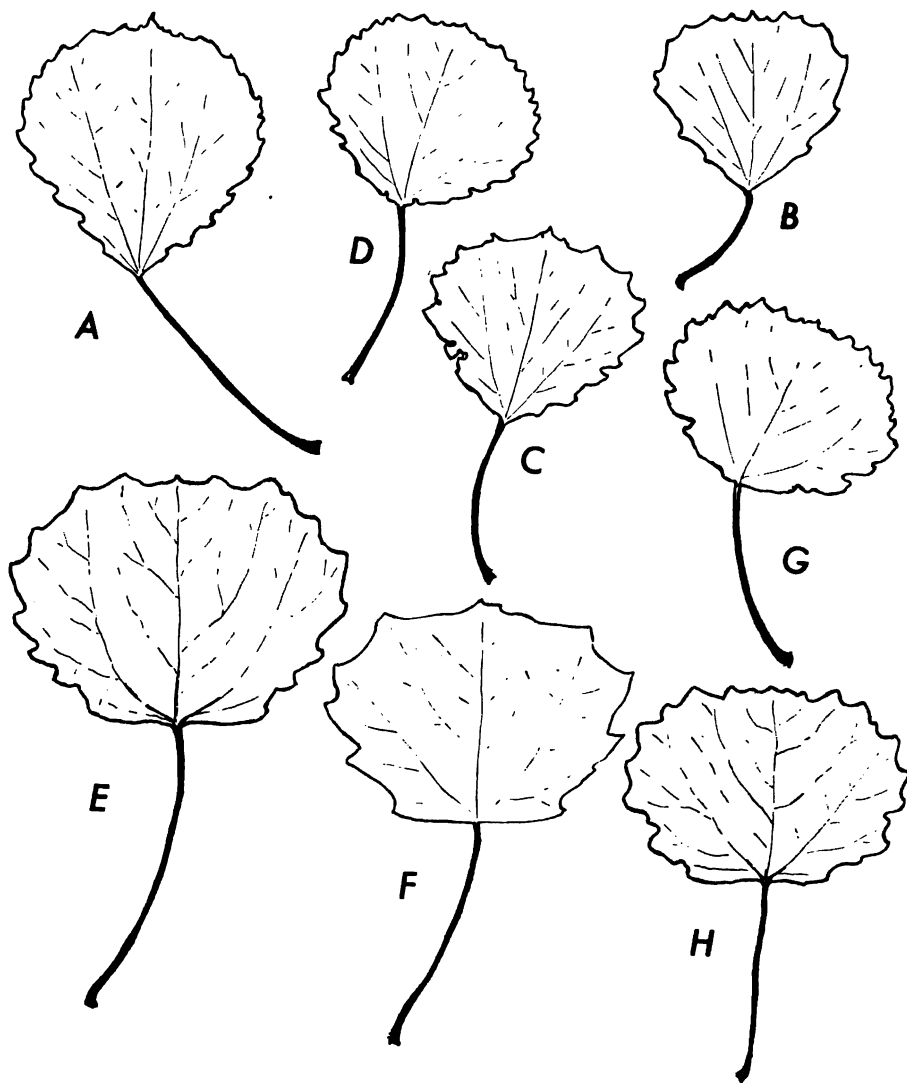


Fig. 2. A—C *P. tremula* f. *flabellata* Hyl. A från Uppland, Erlandsholm pr Rimbo 1937, B från Småland, Nöbböle 1937, C från Västergötland, Vinköl 1938. D *P. tremula* f. *ad formam flabellatam* Hyl. från Södermanland, Dunker, Björndammen 1937. E—H *P. tremula* f. *brevifolia* n.f. E från Södermanland, Länna 1937, F från Uppland, Danmarks s:n, Nontuna 1937, G från Norrbotten, Över-Kalix, Vänsjävär 1937, H från Skåne, Svalöf, Ekebo 1947. — (Alla  $\times 1/2$ ).

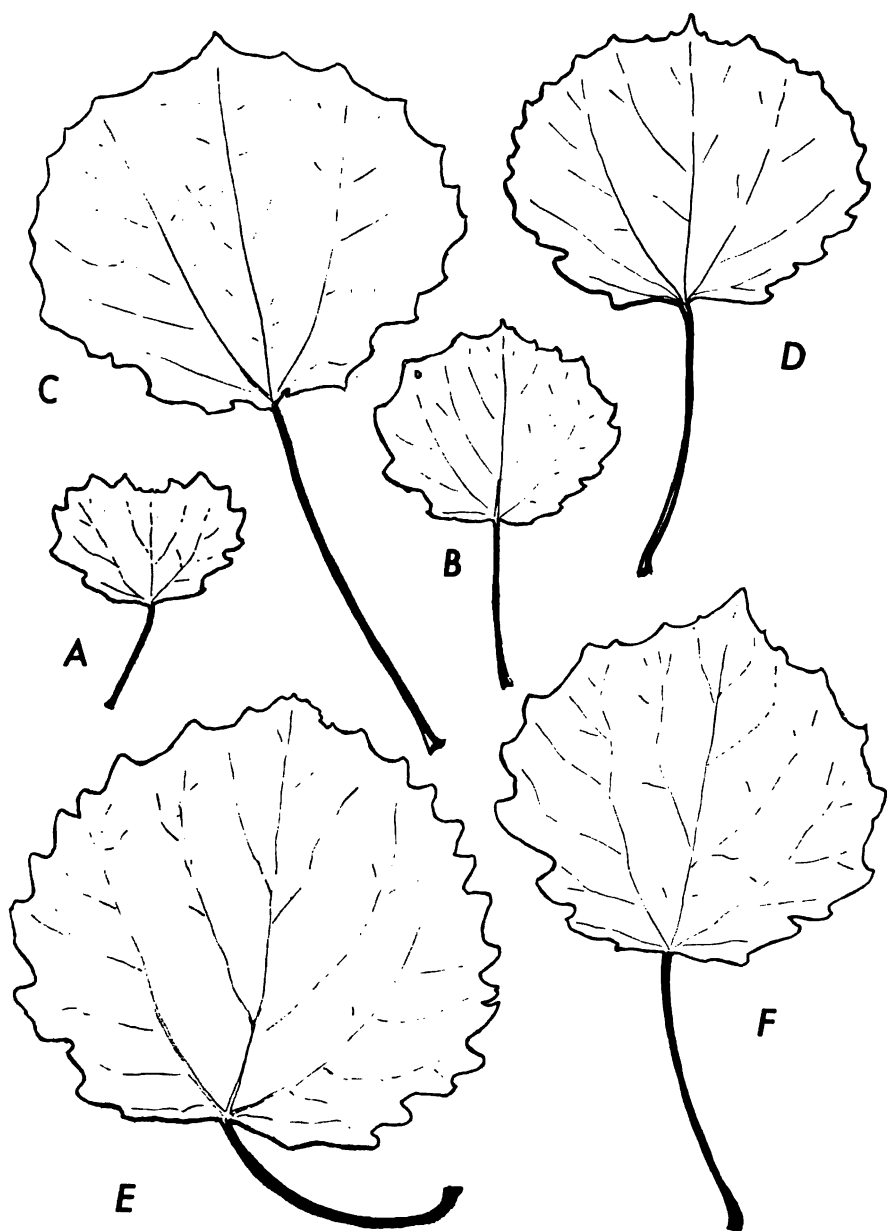


Fig. 3. A *P. tremula* f. *brevifolia* n.f. från Småland, Stenbrohult, Möckelsnäs 1955. B *P. tremula*: bredbladig typ med *brevifolia*-inslag från Östergötland, Linköping, Tornby 1937. C—D *P. tremula* f. *gigas* med breda blad, som tyda på inslag av f. *brevifolia*. C från Medelpad, Tynderö, Våle 1937, D från Norrbotten, Över-Luleå, Vittjärn 1937. E—F *P. tremula* f. *gigas*: E från Uppland, Danmarks s:n, Nontuna 1937, F från Värmland, Ransäter 1938. — (Alla  $\times \frac{1}{2}$ ).



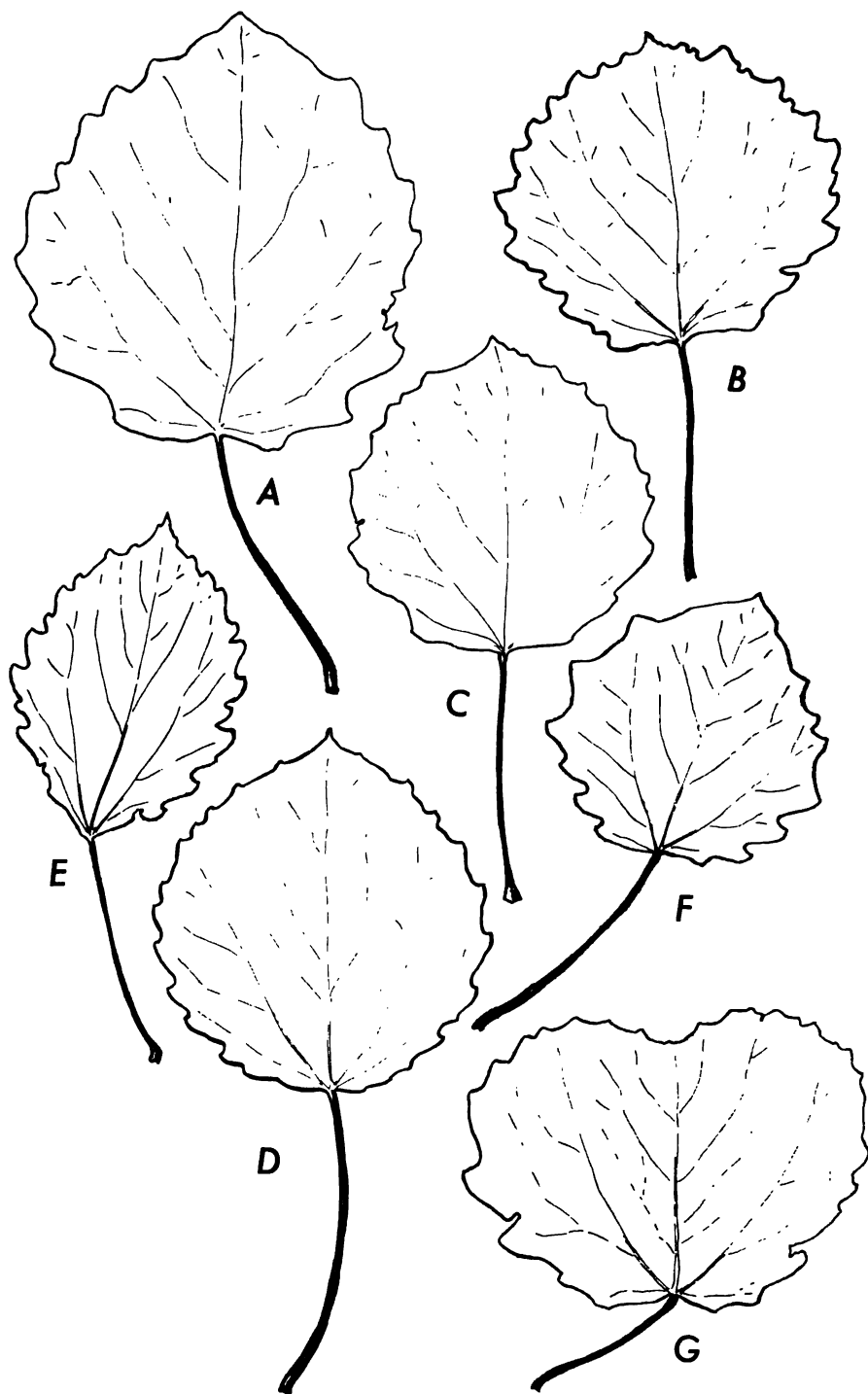


Fig. 4. A—D *P. tremula* f. *gigas*. A från Medelpad, Tynderö, Våle 1938, B från Västerbotten, Degerfors, Rosinedal 1937, C från Norrbotten, Ljuså 1937, D från Norrbotten, Över-Luleå, Vittjärv 1937. E—G Avvikande kortskottsbladtyper av *P. tremula* från Småland, Stenbrohult 1938: E f. *Freytii* Hervier, F f. *ad formam paucidentatam* Hyl., G f. *brevifolia* n.f. på *P. tremula* cfr f. *gigas*. — (Alla  $\times \frac{1}{2}$ ).

Den av HYLANDER från Boh. Skaftö nybeskrivna f. *paucidentata* med nästan helbräddade kortskottsblad har av mig under 1937 års inventeringsresa anträffats i karakteristiskt utbildad form i Ög. Ekenäs, i Srm. Dunker, Björndammen (fig. 1 G) och Länna ovanför Norrälänna by (fig. 1 H) samt i Upl. Erlandsholm pr Rimbo; en relat. fåtandad, om *paucidentata* erinrande bladform antecknades 1937 från Ög. Ringås (fig. 1 I). Före och efter 1937 ha dessutom kortskottsblad av *paucidentata*-typ av mig antecknats från Hl. Onsala (1958), Gtl. Hellevi, Stengårde (1934, E. TH. FRIES), Vg. Hassle (1909), När. N. Hammar, Götunda (1948), Dlr. Mockfjärd, Sähl (1960) och T.L. Jukkasjärvi V. om Tornehamn (1955, C. G. ALM).  $\pm$  *paucidentata*-liknande former äro här jämväl att anteckna från Sm. Stenbrohult (1938; fig. 4 F). Ög. Sommen (1948), När. Lillkyrka, Ekeby (1948) och Upl. Norrtuna (1937).

HYLANDERS från Jmt. Botåsen i Oviken omnämnda f. *flabellata* med kortskottsbladens form »påfallande solfjäderlik, närmare bestämt snarast lik en icke helt utfälld solfjäder, med starkt killik bas och i samband därmed starkt framåtriktade huvudnerver», har jag under 1937 års inventeringsresor mött — i typisk form — på allenast två lokaler: Upl. Erlandsholm pr Rimbo (fig. 2 A) och Sm. Nöbble (fig. 2 B); år 1938 fann jag den på ytterligare en lokal, Vg. Vinköl (fig. 2 C).  $\pm$  *flabellata*-liknande former ha dessutom av mig antecknats från 6 Skånelokaler, från Boh. Lysekil 1959, från Srm. Dunker, Björndammen 1937 (fig. 2 D), från Vstm. Bjurfors och Surahammar, Lisjö 1948, från Upl. Ultuna 1907 och Dlr. Järna 1955 (FOLKE LUNDBERG).

Ännu en från normalformen starkt avvikande kortskottsbladform må här särskilt namngivas: f. *brevifolia* n. f. med påfallande korta och breda — bladbredden avgjort större än längden —, framtill avskurna —  $\pm$  starkt inbuktade,  $\pm$  njurlika blad. Under 1937 års inventeringsresa uppmärksammades denna typ i Srm. Länna (fig. 2 E), Upl. Danmarks s:n, Nontuna (fig. 2 F) och Nb. Över-Kalix, Vänsjärv (fig. 2 G) och har efter 1937 dessutom antecknats från Sk. Svalöf, Ekebo 1947—49 (fig. 2 H), Hästveda 1957 och Ivö 1958 (C. HAMMARLUND), Sm. Stenbrohult, Möckelsnäs 1955 (fig. 3 A) och 1938 (fig. 4 G; cfr f. *gigas*), Ög. Grensholm 1947, Boh. Skaftö, Vägeröd 1951, Vstm. Bjurfors 1948, Upl. Grisslehamn 1951 och Djurö, Vindö 1952, Vrm. S. Finnskoga, Manglidsberget 1948 och Dlr. Orsa, Knoppen 1947. En hel del övergångsformer till annan bladtyp ha även här antecknats, så från Sm. Hallingeberg, Rumma 1937, Ög. Linköping, Tornby 1937 (fig. 3 B), Gtl. Fårön 1953 (Edv. SYLVÉN), Vg. Östad, Sjövik 1951, Srm. Utö 1950 (f. *ad f. flabellatam*), Upl. Ekerö, Ekebyhof 1952 (=föreg.), Dlr. Dalfors 1947 (=

föreg.) och Stjärnsund 1948, Med. Tynderö, Våle 1937 (på f. *gigas*, fig. 3 C) samt Nb. Över-Luleå, Vittjärv 1937 (likaledes på f. *gigas*, fig. 3 D).

Kortskottsbladen hos jätteaspen f. *gigas* Nilsson-Ehle synas med ovan anförda undantag närmast representera den  $\pm$  cirkelrunda—rundat ovala formtypen. De i fig. 3 E—F och fig. 4 A—D avbildade jätteaspebladen avse att åskådliggöra detta och den inom typen härvid rådande variationen.

Samtliga originalteckningar till här meddelade figurer äro utförda av ULLA SYLVÉN-NORRMAN.

Vid genomgång av *Populus tremula*-materialet i Lunds botaniska museum har det visat sig, att samtliga de ovan omnämnda från normaltypen avvikande kortskottsbladformerna där finnas representerade:

*P. tremula* f. *subcordata* från Vg. Toarp, Tubbared 1916 (A. O. OLSON s.n. »f. *subcordata*»), från Stockholm 1891 (OSKAR STERNVALL), från Vb. Vindeln 1917 (S. och A. TH. VIFALL) samt från Nb. Råneå 1939 (ERNST NORDSTRÖM).

*P. tremula* f. *Freynii* Hervier från Hl. Tönnersjöheden 1917 (GUNNAR SCHOTTE), från Vg. Toarp, Bråthult 1916 (A. O. OLSON s. n. »f. *grandidens* n. f.») samt från Ög. Omberg (utan årtal och insamlare).

*P. tremula* f. *paucidentata* Hyl. från När. Abrahamsberg, Backe 1926 (STIG WALDHEIM).

*P. tremula* f. *flabellata* Hyl. från Vg. Toarp, Skär 1916 (A. O. OLSON s. n. »*cuneata* n. f.») och från Boh. Tånga 1920 (J. E. PALMÉR).

*P. tremula* f. *brevifolia* från Sm. Ljungby 1885 (C. M. RYDÉN) och Mönsterås 1920 (O. KÖHLER s. n. »f. *brevifolia*»), från Vg. Råslätt 1909 (A. O. OLSON s. n. »f. *brevifolia* On.») samt från Nb. Kalix 1939 (ERNST NORDSTRÖM).

\*

*Populus tremula* f. *subcordata* N. Sylvén n. f.: Lamina foliorum brachyblastorum ad basin  $\pm$  cordata (Fig. 1 C). — Västerbotten, Degerfors, Hägnäs 1937 (Herb. Fören. Skogsträdsförädling, Ekebo, Svalöf).

*Populus tremula* f. *brevifolia* N. Sylvén n. f.: Lamina foliorum brachyblastorum brevia et lata margine irregulariter dentata, superne margine  $\pm$  recta vel  $\pm$  reniformiter emarginata (Fig. 2 E—H, fig. 3 A). — Södermanland, Länna 1937; Uppland, Danmarks s:n, Nontuna 1937; Norrbotten, Över-Kalix, Vänsjärv 1937 (Herb. Fören. Skogsträdsförädling, Ekebo, Svalöf); Skåne, Svalöf, Ekebo 1947; Småland, Stenbrohult, Möckelsnäs 1955 (Herb. Zoocec. N. SYLVÉN, Lund).

## Three New Species of Inconspicuous Pyrenomycetes

By ANDERS MUNK

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**Synopsis:** Attention is drawn to the extremely rich and mainly unknown flora of small, inconspicuous Pyrenomycetes appearing as saprophytes of second and higher incidence on dead logs and branches. Three new species of Pyrenomycetes with this ecology are described: *Tubeufia minuta*, *Tubeufia corynespora*, and *Delitschia gymnospora*.

In nature a fallen branch or log often becomes the habitat of a succession of fungal communities. As a rule, the production of fungal matter by each species evidently decreases from the first to the last of the successive seral stages of such a community. This can be exemplified by *Nectria sanguinea* (*N. episphaeria*) following *Diatrype stigma* or by *Berlesiella nigerrima* following *Eutypa flavovirens*, and this is just what we should expect, as the amount of available energy in the substrate necessarily decreases during its decomposition. Thus, as an ecological community the fallen branch can be compared with the community of Protozoa successively dominated by different species described in WOODRUFF's (1912) classical investigation on the succession in boiled hay with addition of pond water.

The "food chain" concept can hardly be used literally for this succession of fungus communities, because — according to available information — the fungi of second or higher incidence (hypersaprophytes) probably live upon wood and bark left over by the saprophytes of first incidence as well as upon the remnants of the first fungi themselves. It follows from the second law of thermodynamics, however, that the gross picture of energy flow must be the same as in a typical food chain.

It has appeared now that the fungal flora of hypersaprophytes is

surprisingly rich in species of Pyrenomycetes. Most of them have very small, solitary perithecia and are only observed under the dissecting microscope. Many new species will have to be described, for instance in the *Coronophorales* and in the groups of *Pleosporales* which I have previously named *Herpotrichiellaceae* (see MUNK 1957: 438) and *Massariniaceae* (see l.c.: 441). I take this opportunity to withdraw my advice to Pyrenomycete collectors (l.c.: 16) to reject material which, in the field, appears to have old and empty perithecia: If you collect a branch with perithecia in evidently good condition, you will find one or — rarely — two species on it. If you collect a branch with empty perithecia of the species of first incidence, you are likely to find five or six species of hypersaprophytes on it!

This paper deals with species of two genera which are comparatively well known from recent studies.

### ***Tubeufia* Penz. & Sacc., emend. Booth 1964**

Type: *Tubeufia coronata* Penz. & Sacc. 1897. — *Malpighia* 11: 517.

BOOTH (l.c.: 10) gives a good discussion on the nomenclature and taxonomic position of *Tubeufia* together with a key and descriptions to the eight species known. His paper, issued on January 1<sup>st</sup> 1964, arrived to me in due time, as I collected the two species described here in December 1963 and January 1964.

According to BOOTH the genus belongs in *Pleosporaceae*. This opinion is well justified as long as the name "*Pleosporaceae*" serves to cover all *Pleosporales* which cannot be placed in one of the few well-defined families. It seems probable, from my recent studies, that the number of families segregated from *Pleosporaceae* will eventually be rather large; then *Tubeufia* will probably constitute a small family of its own, evidently together with species which can formally be referred to *Acanthostigma* De Not. But it would be premature to make such an arrangement now; an appropriate statement about the present state of affairs in the taxonomy of *Pleosporaceae* was made by LUTTRELL (1965: 830): "This is the largest group in the *Loculascmycetes* and must be divided eventually into a number of families, but the lines of such a division are barely emerging".

BOOTH did not investigate details of fruit-body morphology in *Tubeufia*. Previously I have described and figured (MUNK 1957: 474) a peculiar structure of the fruit-body in *Tubeufia cerea* (= *Ophionectria cerea* (Berk. & Curtis) Seaver): The interascicular filaments are con-

tinuous with vertical filaments extruding through the porus. It appears from the descriptions and drawings below that the two new species display each its own characteristic variant of the same theme, and that *Tubeufia cerea* comes in between *T. minuta* and *T. corynespora* in this line of the pattern of variation.

*Tubeufia minuta* n. sp.

Ascocarpia 90—110  $\mu$  diametro, fusco-atra, libera, solitaria vel laxe gregaria, ex basi applanato leniter elongata, ad apicem rotundata. — Peridium pellucidum, fuscum, 12—14  $\mu$  crassum, tuberculis obsoletis maculatum, ad basim non distinctum. — Asci 45—54 $\times$ 8—9  $\mu$ , bitunicati pariete crassissimo, sessiles, oblongi. Textura interascicularis densa, firme cohaerens, ex filamentis quasi paraphysiformibus constructa. — Ascosporae 2—4-seriatae, 16—21 $\times$ 3—4  $\mu$ , valde clavatae, curvatae, biseptatae, guttulatae, hyalinae.

In Pyrenomycetibus vetustis et in cortice putrescente. — Typus die 1. Decembris 1964 in silva Boserup Selandiae Daniae collectus, matrix: *Diatrypella favacea* vetusta in ramis *Betulae*.

Mycelium inconspicuous, composed of 1.5—3  $\mu$  thick, light brown, sinuate, richly branching hyphae which are observed within the substrate as well as on its surface.

Fruit-bodies black, free, solitary or sparsely gregarious, 90—110  $\mu$  large, barrel-shaped, with a flat base and rounded above. Porus 25—30  $\mu$  wide, represented by a slight apical depression paved with undifferentiated interascicular tissue.

Peridium 12—14  $\mu$  thick, pellucid, dark brown, with small, irregular, slightly darker tubercles on the surface, textura prismatica—subglobosa, composed of 3—4 layers of 3—5  $\mu$  large cells with moderately thick walls. In the base no peridial tissue was observed.

Asci 45—54 $\times$ 8—9  $\mu$ , bitunicate with very thick and persistent walls, sessile, thickest at the middle or a little below. Interascicular tissue indistinctly paraphysoid, rather firmly coherent.

Ascospores 2—4-seriate, 16—21 $\times$ 3—4  $\mu$ , clavate with a broadly rounded apex and an almost pointed base, generally slightly curved, 3-celled, with a large oil-drop in each cell and often one or two small ones; hyaline.

Found on old Pyrenomycetes and inside rotting bark, Dec.—Jan.

Type: On and around old *Diatrypella favacea* on bark of *Betula*. — Sjælland: Boserup 1. xii. 1964.

Other finds: On old *Diaporthe leiphaemia* on *Quercus*. — Sjælland: Jægersborg Indelukke 21. i. 1964. — On the inside of thick, rotting bark of *Betula*, soc. *Rhamphoria pyriformis*. — Sjælland: Bøllemsen 2. xii. 1964.

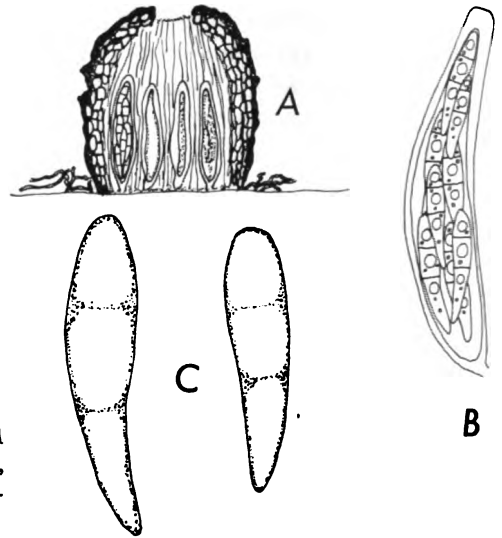


Fig. 1. *Tubeufia minuta* n.sp. — A Fruit-body ( $\times 200$ ), B ascus ( $\times 1030$ ), and C two spores as seen in lactophenol ( $\times 2400$ ).

*Tubeufia corynespora* n. sp.

Ascocarpia nigra, solitaria, libera, 250—300  $\mu$  lata et alta, truncato-conica vel semiglobulares, ad basim applanata. — Peridium c. 50  $\mu$  crassum, textura fere intricata, ex cellulis 3—4  $\mu$  crassis, dilute olivaceis, extus fusco-atris constructum. Papilla pulvinata, c. 150  $\mu$  lata, ex hyphis subparallelis, dense stipatis constructa. Ad basim ascocarpii peridium obsoletum. — Asci 90—100  $\times$  15—18  $\mu$ , sessiles, clavati fere cylindranei, bitunicati pariete crassissimo. Textura interascicularis densa, luteola fere hyalina, ex filamentis c. 1.5  $\mu$  crassis constructa, cum textura papillae continua. — Ascosporae (50—) 70  $\times$  4  $\mu$ , 12—14-cellulares, cellula subapicali crassissima, fere hyalinae.

Typus die 15. Decembri 1963 in silva Ermelunden prope Hafnias Selandiae Daniae collectus, matrix: Cortex putrescens, ascocarpia in superficie peridermii suberosi sedentia.

Fruit-bodies blackish, solitary, widely scattered, superficial or occasionally with the sides covered by a thin layer of the corky periderm, even including in the peridium remnants of the cork, truncate-conical to semiglobate or subspheric with a flattened base, 250—300  $\mu$  wide and high; the papilla is represented by a 150  $\mu$  wide, low cushion of light-coloured tissue.

Peridium ca. 50  $\mu$  thick, plectenchymatous, cells 3—4  $\mu$  thick, rather thick-walled, light olive greenish, blackish to the outside. Ostiolar cushion built up of thin-walled hyphae, 2—3  $\mu$  thick, converging towards the middle, diverging towards the periphery; these hyphae are

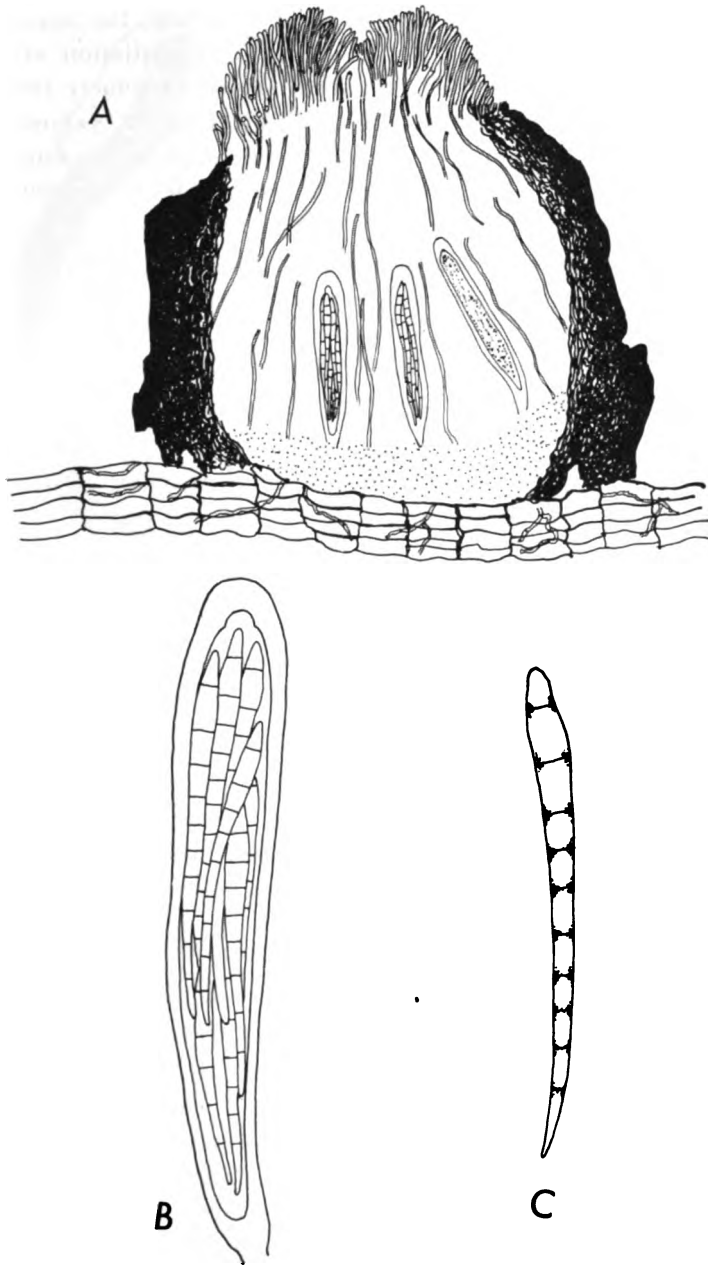


Fig. 2. *Tubeufia corynespora* n.sp. — A Fruit-body ( $\times 200$ ), B ascus, and C spore ( $\times 1030$ ).



continuous below with the peridium as well as with the interascicular tissue. In the bottom there is no peridial differentiation at all; the asci spring from an indistinct hyaline tissue of extremely thin-walled cells. Centrum solid even when dry, with a tinge of yellowish. Asci  $90\text{--}100 \times 15\text{--}18\ \mu$ , 8-spored, subcylindric, slightly clavate, sessile, bitunicate, extremely thick-walled; interascicular tissue dense, filaments ca.  $1.5\ \mu$  thick.

Ascospores in a cluster ( $50\text{--}$ )  $70 \times 4\ \mu$ , 12—14-celled, the second cell from above thickest; from this cell the proximal end of the spore tapers gradually into a point. The spores are hyaline or — when perfectly mature — with a very faint yellowish tinge.

On thick, rotting bark, seated on the surface of the periderm. — Sjølland: Eremelunden 15/xii 1963.

The present species is certainly a good member of the genus *Tubeufia* even if the plectenchymatous peridium is very different from the peridium of e.g. *T. cerea*. — The ostiole seems to represent an extreme variant of the structure found in *T. cerea* (cp. MUNK 1957: 473, fig. 202).

The peridium is by no means coaly; it is very easy to cut, just as in *T. cerea* and in *T. minuta*.

### ***Delitschia* Auersw.**

Type: *Delitschia didyma* Auersw. 1866. — Hedwigia 5: 49.

This genus is generally regarded as exclusively coprophilous; species on other substrates formerly referred to *Delitschia* have now been placed elsewhere in the system. The only species on wood recently referred to *Delitschia* is *D. geminisporea* Sacc. & Flag. (= *Pachyspora gigantea* Kirschstein), listed by MÜLLER & VON ARX (1962: 349) as a true *Delitschia*. It has two-spored asci with very large spores and is out of question for identification of the fungus described here.

The present species fits in with the genus *Delitschia* in all parts: Peridium, papilla, asci, interascicular tissue, and ascospores. The spores, however, show two unusual variants: They have no gelatinous coverings, and the germ slit is very short, extending only along the middle third of each cell. It seems reasonable to assume that the lack of gelatinous covering is biologically significant in relation to the non-coprophilous habitat (cp. the genus *Coniochaeta*: Coprophilous species with and lignicolous species without gelatinous coverings to

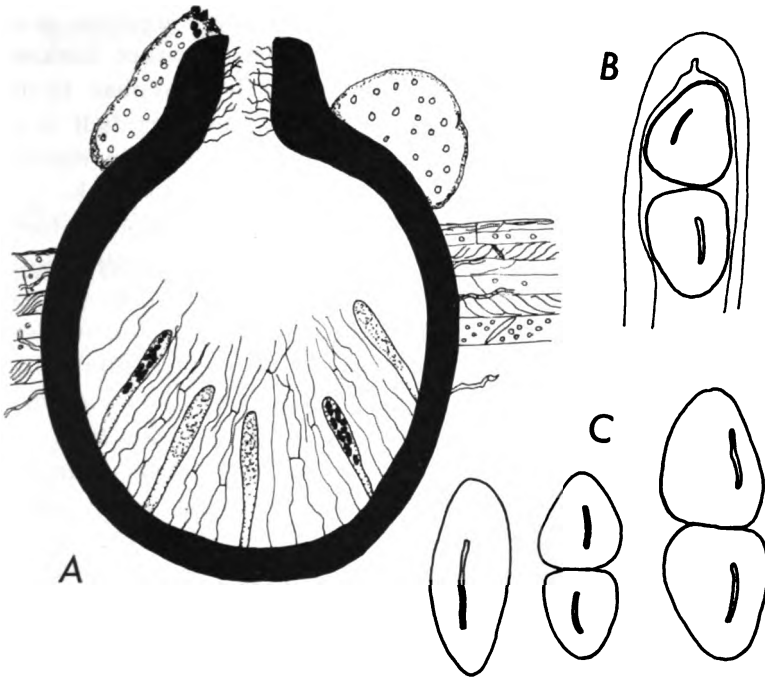


Fig. 3. *Delitschia gymnospora* n.sp. — A Fruit-body ( $\times 100$ ), B ascus-top, and C spores ( $\times 1030$ ).

their spores); and that the unique germ slit suggests some remoteness of relationship with the coprophilous species of *Delitschia*.

*Delitschia gymnospora* n.sp.

Ascocarpa solitaria, 500—600  $\mu$  diametro, 700—800  $\mu$  alta, pro maxima parte immersa, papilla 200  $\mu$  crassa. — Peridium c. 50  $\mu$  crassum, fere opacum, densum, ex cellulis parvis 2—4  $\mu$  diametro constructum. Porus latus, filamentis glutinosis periphysiformibus 1.5—2  $\mu$  crassis instructus. — Asci octospori, c. 150  $\mu$  longi, 18—22  $\mu$  crassi, bitunicati pariete crasso, tamen deliquescente. Textura interascicularis laxe retiformis, ex filamentis glutinosis, paraphysiformibus, 1  $\mu$  crassis constructa. — Ascosporae uni- vel biseriatae, 26—31  $\times$  9.5—12  $\mu$ , aequaliter bicellulares, ad septum valde constrictae, mox disrumpentes. Cellulae sporae rotundate triangulares, fuscae, sine tunica mucilaginea, fissura germinativa brevi munitae.

Typus die 4. Februarii 1964 in silva Rude Skov Selandiae Daniae collectus, matrix: Truncus putridus *Fagi silvaticae*; soc. *Chlorophyceae* spp.; locus siccus, soli valde expositus.

Fruit-bodies 500—600  $\mu$  diam., 700—800  $\mu$  high, half or more immersed, body slightly vertically elongate, with a distinct papilla ca. 200  $\mu$  thick.

Peridium ca. 50  $\mu$  thick, black, in thin sections greenish, of a very dense, small-celled structure, cells 2—4  $\mu$  large, rather thick-walled; outside the peridium are seen brown, 4—5  $\mu$  thick hyphae. In the free portion the peridium is slightly thicker, and the outer half is heavily carbonized with almost no lumens of the cells. Porus wide, wall covered with slimy, entangled periphysoid filaments 1.5—2  $\mu$  thick.

Asci 8-spored, ca. 150  $\mu$  long, 18—22  $\mu$  thick, distinctly bitunicate and thick-walled; but both the outer and the inner wall are delicate and fugacious. Active discharge of the spores is verified by the presence of many discharged spores outside the fruit-body near the ostiole. Paraphysoid tissue well developed, composed of entangled, slimy filaments, ca. 1  $\mu$  thick, very often branched at right angles and anastomosing.

Ascospores 1—2-seriate, 26—31 $\times$ 9.5—12  $\mu$ , equally bicellular, strongly constricted, easily disrupting; cells rounded—subtriangular, rather dark brown, without a gelatinous covering; each cell with a longitudinal germ slit extending only along the middle  $\frac{1}{3}$  of the cell. An abnormal single-celled spore was observed; its germ slit extends  $\frac{1}{3}$  of the whole spore.

On a rotten stump of *Fagus* exposed to sun and wind (very young plantation of *Quercus* on a south-slope), soc. an abundant vegetation of green algae with rounded cells and large slimy sheaths (cfr. *Palmogloea* or *Gloeocystis*). The slimy substance of the algae seems to be the reason why the spores stick to the substrate; they have no slimy covering of their own as in other species of *Delitschia*. — Sjælland: Rude Skov 4/ii 1964.

Types are preserved in Botanical Museum of the University, Copenhagen (C).

The main work of this investigation was carried out at the Institute of Thallophytes, University of Copenhagen. I am indebted to the head of the Institute, professor MORTEN LANGE, for excellent working facilities and stimulating discussions.

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## On the Status of *Acrocephalus* Benth. with Some New Species from Katanga (Congo Republic)

By W. ROBYNS

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*Acrocephalus* Benth. was founded, in 1829, on an Asiatic species: *A. capitatus* Benth. and afterwards extended to African species, which constitute at present the bulk of the genus, with some 100 species out of a total of 110.

In 1959, P. DUVIGNEAUD and J. PLANCKE, after general considerations on the strong evolutionary pressure disclosed by the actual Sudano-Zambesian flora, simply presumed that the capituliform inflorescence of *Acrocephalus* is (1959, p. 217) “un mélange hétérogène de genres distincts”, originating from parallel evolution rather than from common ancestry and to which exaggerated weight has been given. Drawing attention to the heterogeneity of the genus, they specially pointed out that the subdivisions set up by J. BRIQUET (1897) and based on the divisions of the flowering calyx lips are very subtle and artificial. They proposed therefore a new Zambesian genus: *Haumaniastrum* Duvigneaud et Plancke, to include primarily the frutescent — rather than arborescent! — species from Katanga, the first of which was collected in the field by the present author in 1926 and described and illustrated as *Acrocephalus suberosus* Robyns et Lebrun (1928, p. 182 and plate).

According to DUVIGNEAUD and PLANCKE, *Acrocephalus* is to be entirely restricted to the Asiatic species, which are all small herbaceous annuals. The calyx is ovate, slightly gibbose at the base, with glabrous tube and lips of the *Heterochili* type (1/4); it is slightly accrescent in fruit. The corolla remains inserted, and is hardly bilabiate; the stamens are only slightly longer than the corolla.

*Haumaniastrum*, on the other hand, must include all the African species, which are herbaceous, suffrutescent or lignose. The calyx

shows a cylindrical slightly curved mostly hairy tube and the lips are always of the *Odontochili* type (3/2), even when the teeth are little marked through fusion or used out by age, giving the impression of the types: *Holochili* (1/1), *Meriochili* (1/2) and *Schizepichili* (3/1); it is mostly very accrescent in fruit from 2 mm to 10 mm. The corolla is larger, with a long exserted tube and more markedly bilabiate, whereas the stamens are exserted.

In conclusion, both authors state that the difference between the Asiatic and the African *Acrocephalus* is not a mere question of geographical distribution, but is equally shown by their floral structure and their vegetative organs.

In 1962, J. K. MORTON declared textually (1962, p. 239) "I have no hesitation in adopting this generic name for all those West African plants formerly placed in the genus *Acrocephalus*" and, without any further explanation, he established several new combinations (1962, p. 266 and 267), extending moreover the area of *Haumaniastrum* to cover all the savanna regions of tropical Africa (1963).

From a previous revision of the Congo species of the genus (ROBYNS & LEBRUN 1928), from the actual study of the new Katanga species described further and of several African species of BRIQUET cited hereafter, as well as from a survey of the literature, I cannot agree with the preceding authors, for the following reasons:

1) According to DUVIGNEAUD and PLANCKE, the *Heterochili* type is entirely limited to the Asiatic species, and *A. gracilis* Briq., an African species, indicated by BRIQUET (1897) and ROBYNS & LEBRUN (1928) as belonging to this type, is rather of the *Odontochili* type, as results from an examination of the type specimen in the Kew Herbarium by the two cited authors (1959, p. 219).

BRIQUET (1897) classified also in his *Heterochili*, following species from Angola: *A. minor* Briq., *A. sericeus* Briq., *A. reticulatus* Briq., *A. Mechowianus* Briq. and *A. praealtus* Briq., besides a species from Nyasaland: *A. callianthus* Briq. No mention at all is made of these taxa by DUVIGNEAUD and PLANCKE.

Thanks to the courtesy of the Director of the Royal Botanic Gardens, Kew, I had the opportunity of examining the type material of *A. callianthus*, *A. gracilis* and *A. praealtus* and I am enabled to ascertain that the first two species have a flowering calyx of the *Holochili* type, whereas the last one has a flowering calyx of the *Schizepichili* type.

For all that, the *Heterochili* type is not confined to the Asiatic species, as, from its original description, *A. Klossii* Wernham from

South Annam, has a calyx of the *Holochili* type and consequently links up with the African species.

2) From a careful investigation of the text of DUVIGNEAUD and PLANCKE, it ensues without doubt, that, besides the calyx tube, all other characters indicated as different for the two genera are either non-existent or merely quantitative i. e. showing a more or less great variation of degree with all intermediates. Hence they are to be discarded entirely for generic delimitation.

a) Herbaceous and frutescent species such as *A. fruticosus* Dunn coexist in Asia and the latter are certainly not restricted to Africa.

b) In several Asiatic species, the flowering calyx tube has been described as tubular: *A. capitatus* (HOOKER 1842, pl. 456, fig. 1), *A. fruticosus* and *A. spicatus* Robinson, or as campanulate: *A. palniensis* Mukerjee and *A. verbenaeifolius* Watt ex Mukerjee, and it seems to become gibbose at the base only in fruit: *A. capitatus* (HOOKER 1842, pl. 456, fig. 2). The calyx tube is not glabrous but hairy, even in the fig. of *A. capitatus* by DUVIGNEAUD & PLANCKE (1959, p. 220, fig. 1 A) given as typical for *Acrocephalus*; it is moreover villose in *A. palniensis* and *A. verbenaeifolius*. Lastly, the calyx is always accrescent to a marked degree in fruit, at least from 2 mm to 6 mm.

In the African species, the calyx tube is said to be slightly curved and it is figured as such by DUVIGNEAUD & PLANCKE (1950, p. 220, fig. 1 C) for *H. polyneurum* (S. Moore) Duvign. et Plancke, taken as the nomenclatural type species of *Haumaniastrum*. Dissection of the type specimen and of several other specimens of this species shows however a very straight flowering calyx tube both in front view and in side view. This occurs in all the African species known to me and is illustrated by OLIVER (1875) for the following African species: *A. cylindraceus* Oliv. (pl. 132, fig. 1, 3), *A. caeruleus* Oliv. (pl. 133, fig. 1, 3), a most variable species, and *A. lilacinus* Oliv. (pl. 134, fig. 1, 3), as well as by MORTON (1963, fig. 311 A). It can also be seen in our fig. 2 A and B. The enlarged fruiting calyx can remain straight as in our fig. 2 D and E, but it may show a very slight curve on the adaxial side appearing only in side view. This occurs even in some Asiatic species and it seems to be a mere result of growing in a congested capitule. The fruiting calyx becomes also more or less gibbose at the base, as shown in our fig. 2 D.

c) The size of the corolla greatly varies even in the Asiatic species, where it is clearly exerted in *A. capitatus*, attaining almost twice the length of the calyx (HOOKER 1842, pl. 456, fig. 1). In the African

species, the corolla likewise shows variation to a marked degree in length and can be relatively short and little or hardly exserted. The corolla lips may be little marked or more or less pronounced and unequal according to the species. The same situation is shown by the stamens, which can be more or less exserted.

All in all, there is no sharp delimitation whatever in vegetative and floral characters between *Acrocephalus* and *Haumaniastrum*. The calyx type alone cannot be used for generic delimitation, the more that DUVIGNEAUD & PLANCKE (1959) have weighted it quite differently in both genera. In *Haumaniastrum*, they neglected purposely the *Holochili*, *Meriochili* and *Schizepichili* types, contending that they are mere derivations of the sole diagnostic *Odontochili* type, whereas in *Acrocephalus*, the *Heterochili* type was the only one stressed. Although the different calyx types of BRIQUET (1897) are not always constant and well marked, as was already pointed out by ROBYNS & LEBRUN (1928, p. 171 and 172) it is to be emphasized that they do exist and that they remain very useful for actual classification. If generic value at all is to be attributed to any of them, there seems to be no reason to treat them differently and not to recognize as many genera as there are calyx types, the more that DUVIGNEAUD & PLANCKE (1959, p. 219) state that *A. villosus* Benth. from Madagascar and *A. cylindraceus*, both belonging to the *Holochili*, are of a type quite different from the African species.

Finally, it is at least misleading to correlate evolution with phenetic classification and advocating evolutionary speculations as evidence for splitting of taxa cannot make taxonomic sense. It is further astonishing that the evolutionary pressure in the Sudano-Zambesian flora has resulted in splitting off an Asiatic genus rather than in producing several African genera.

In conclusion, as matters stand now and in the absence of a detailed revision or of a monograph of the whole taxon, it is hardly possible to accept the genus *Haumaniastrum* as it has been circumscribed. In the meantime, I continue to describe the following new species from Katanga under *Acrocephalus*.

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*Acrocephalus graminifolius* Robyns sp.nov.; habitu caespitoso. foliis linearibus nervisque omnino parallelibus et capitulis solitariis depresso-globosis et pro rata magnis primo visu inter omnes species valde distinctus. — Fig. 1 and 2.



MISSION G. F. de WITTE  
PARC NATIONAL DE L'UPEMBA

Chuvu des Mangi, alt. 1700m.  
20.10.1962  
sur terre humide  
sur terre humide  
sur terre humide

HERBARIUM HORTI BOTANICI BRUXELLENSIS  
(BELGIUM)

*Acrocephalus graminifolius* Robyns  
folius Robyns & n.  
Holotypus  
22-24-1962  
Robyns

Herbar des Paysans  
de l'Upemba

03834

Fig. 1. *Acrocephalus graminifolius* Robyns. Holotype. (Photo L. VERELST).



*Herba* perenns, dense caespitosa et usque ad 20 cm alta, rhizomatosa, rhizomate lignoso crassoque. *Folia* basilaria dense rosulata, numerosa, sessilia; lamina linearis, apice sensim attenuata, usque ad 15—20 cm longa et 1—3 mm lata, subrigida et interdum  $\pm$  convoluta, ima basi lanato-pubescent, deinde glabrescens, costa media praecipue pagina inferiore prominente, costis secundariis utrinsecus medianae 2—4 omnino parallelibus et pagina inferiore prominulis. *Rami* floriferi plures pro specimine, plerumque simplices, 10—20 cm longi, plerumque 2(3)-nodi et ad nodos 2—3 foliis caulinariis basilaribus similibus sed brevioribus ornati, subgraciles ad crassiusculi et insigniter pilis albidis lanato-villosi. *Capitula* solitaria, ampla, depresso-globose 1,5—4 cm diam. (statu fructifero), sicco pallide fulvescentia, insigniter involucreta, multiflora; bractaeae extimae foliis caulinariis similes sed minores; bractaeae sequentes e basi  $\pm$  late oblonga ad obovata 1—1,5 cm longa submembranacea et utrinque sed praecipue extus lanato-villosa longe cuspidatae, cuspidate 1,2—1,5 cm longa et foliis simili sed sensim reducta; bractaeae interiores late obovatae ad deltoideae, apice breviter apiculatae, 12—18 mm longae et 10—13 mm latae, tenuiter membranaceae, utrinque sed praecipue extus lanato-villosae, ad apicem capituli gradatim reductae. *Flores* subsessiles; calyx 1,5—1,8 mm longus, sub fructu accrescens, tubulosus, extus dense villosus, bilabiatus, labiis subaequalibus subintegris vel labro obscure sub 3-dentato et labiolo vix emarginato; corolla e collectoribus vivo alba ad pallide purpurea, longe exserta, 8 mm longa; tubus elongatus, cylindricus et apicem versus ampliatus, vulgo 6 mm longus, glaberque; labrum 3-lobatum, lobo mediano longiore et apice distincte emarginato, extus apicem versus sparse pubescens; labiolum labrum vix superans, integrum, apice subrotundatum et extus apicem versus sparse pubescens; stamina breviter exserta, didynamia, inferiora longiora; stylus gracilis et apice 2-lobatus. *Nuculae* oblongae ad obovatae, 2—2,5 mm longae, laeves glabraeque.

**Congo:** District of Upper Katanga — Parc National de l'Upemba, Kabwe sur Muyé, alt. 1320 m, en savane herbeuse, fleurs blanches, mai 1948, G. F. DE WITTE 3834 (holotypus BR); Idem, rive droite rivière Mumbale, alt. 1760 m, plateau, savane herbeuse, fleurs mauve pâle, mars 1959, DE WILDE 728.

**Vernacular name:** Mubela (dial. Kiluba).

This very remarkable new species shows some variation in the divisions of the calyx lips, especially in the fruiting stage. It seems however to be placed in the *Holochili* Briq. where it recalls *A. polyneurus* S. Moore by its parallel-nerved leaves, a character occurring also in *A. linearifolius* De Wild. of the *Odontochili* Briq. Unlike all the known species of the genus, most of the linear leaves of *A. graminifolius* are however arranged in a dense radical cluster by which it resembles closely the caespitose hemicryptophytic sedges and grasses. Like many of the latter it is xerophilous and adapted to the prevailing dry climate of the grassy plateaus of Upper Katanga where the frutescent *Acrocephalus* seem to be endemic.

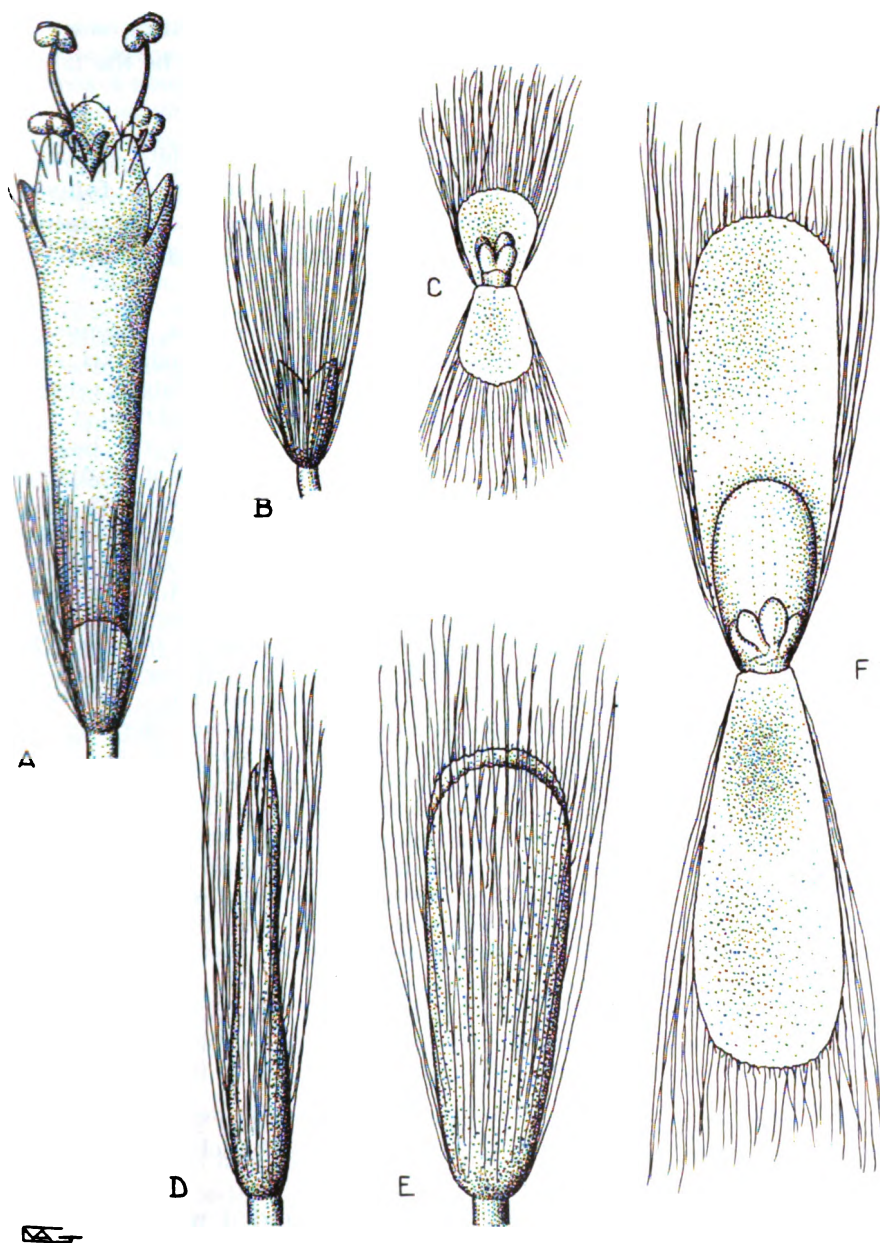


Fig. 2. *Acrocephalus graminifolius* Robyns. A Open flower, back view. — B Flowering calyx, side view. — C Flowering calyx, laid open. — D Fruiting calyx, side view. — E Fruiting calyx, front view. — F Fruiting calyx, laid open. (From holotype. All  $\times 10$ ).

The heads of *A. graminifolius* may attain in the fruiting stage up to 4 cm in diam. (specimen DE WILDE 728) and seem to be the largest known in the genus.

*Acrocephalus termiticola* Robyns sp. nov.; ex affinitate *A. rosulati* De Wild., sed scapis monocephalis crispato-pubescentibus, foliorum lamina haud bullata et pagina inferiore hirsuto-pubescente, capitulis majoribus, bracteis interioribus late deltoideis et floribus pro rata majoribus sat recedit.

Herba perennis, erecta, ut videtur usque ad 40 cm alta, rhizomatosa. Folia omnino basalia, verisimiliter 4-rosulata, petiolo subnullo vel usque ad 6—7 mm longo crasso supra canaliculato sed subtus rotundato et crispato-pubescente suffulta; lamina elliptica ad ovato-elliptica, basi obtusa et apice rotundata, marginibus superficie rotundato-crenatis, 4,5—6,5 cm longa et 3—4 cm lata, sicco leviter discolor et pagina superiore obscurior, papyracea, pagina superiore sparse puberula, pagina inferiore hirsuto-pubescent, nervis lateralibus utrinsecus mediani 10—12 arcuatis pauce conspicuis necque prominulis. Scapus solitarius, efoliatus, rotundatus, obscurus, crispato-pubescent, monocephalus. Capitula solitaria, ovoidea, vulgo 14 mm longa et 12 mm lata, fulvo-velutina, multiflora; bractee extimae lanceolatae, usque ad 1,5 cm longae, subfoliaceae, hirsuto-pubescentes; bractee interiores late deltoideae, majores 6—7 mm longae et 9—16 mm latae, submembranaceae, extus supra basin velutinae et apicem versus pubescentes, intus parte superiore hirsuto-pubescente excepta glabrae; bractee superiores plerumque reductae. Flores subsessiles; calyx vulgo 3 mm longus, sub fructu accrescens, subcampanulatus, extus longe villosus, bilabiatus, labiis fere aequalibus integris apiceque triangularibus et minute ciliolatis; corolla longe exserta, vulgo 8 mm longa; tubus elongatus, e basi sensim ampliatus, vulgo 6 mm longus glaberque; labrum 3-lobatum, lobo mediano latiore longioreque et apice distincte emarginato, lobis extus apicem versus fasciculato-pilosis; labiolum labrum paullo superans, apice rotundatum et extus apicem versus fasciculato-pilosum; stamina didynamia, distincte exserta, inferiora longiora; stylus gracilis, apice 2-lobulatus. Nuculae non visae.

**Congo:** District of Upper Katanga — Environs Elisabethville, près Jardin Botanique, sol latéritique de termitières grises, 35 à 60 cm de haut, janv. 1938, P. QUARRÉ 5028 (holotypus BR).

This new species of the *Holochili* Briq., is easily recognized by its scapes of solitary rather large flower heads with deltoid bracts and by its flowers up to 8 mm long.

The collector reports it from a termite hill and it would be worth well to know if this species is growing only in this peculiar habitat.

*Acrocephalus viridulus* Robyns sp. nov.; ex affinitate *A. rosulati* De Wild., a quo foliis sicco viridulis, capitulis apice scaporum solitariis depresso-globosisque satis differt.

*Herba* perennis, erecta et usque ad 30 cm alta, rhizomatosa, rhizomate tuberoso-lignoso plerumque napiformi et usque ad  $\pm 1$  cm diam. Folia basilaria 4-rosulata, subpetiolata; lamina oblongo-elliptica ad ovato-elliptica, basi breviter attenuata et ad margines  $\pm$  crenata, apice breviter acuta ad subrotundata, usque ad 5 cm longa et 3 cm lata, sicco laete viridula, pagina superiore bullata glabraque et nervis impressis, pagina inferiore in nervis molliter albido-pubescens, nervis lateralibus utrinsecus mediani circiter 10 arcuato-adscententibus et pagina inferiore cum reticulo valde prominentibus. *Scapi* solitarii vel usque ad 4 pro specimine, nudi vel interdum parte superiore par unum foliorum sessilium oblongo-lanceolatorum parvorumque ferentes, graciles, obscure violacescentes et omnino crispato-pubescentes. *Capitula* solitaria, interdum etiam capitulum unum utrinque ex axilla paris foliorum scaporum natum, depresso-globosa, usque ad 1,2—1,3 cm lata et 0,8 cm alta, multiflora; bractee exteriores 2 foliosae, viridulae, foliis subsimiles sed tantum usque ad 1 cm longae; bractee sequentes 2 etiam  $\pm$  foliosae sed late triangulares acuminataeque, 4—5 mm latae, et 7 mm longae, extus villosae at intus glabrae; bractee interiores late rotundatae apiculataeque, 3 mm latae, membranaceae, extus lanato-villosae et intus glabrae. *Flores* sessiles; calyx 2 mm longus, sub fructu accrescens, tubulosus et apicem versus leviter ampliat, extus dense villosus, bilabiatus, labiis subaequalibus rotundatis integris obscureque ciliolatis; corolla vivo albida, longe exserta, vulgo 6 mm longa; tubus elongatus, cylindricus, apicem versus ampliat, vulgo 3,5 mm longus glaberque; labrum 3-lobatum, lobo mediano apice distincte emarginato, extus dense villosus; labiolum labrum pauce superans, integrum, apice rotundatum, extus  $\pm$  villosum; stamina usque ad 1,5—2 mm longe exserta, didynamia, inferiora longiora, demum deflexa; stylus gracilis, staminibus superioribus aequilongus, apice 2-lobatus. *Nuculae* non visae.

**Congo:** District of Upper Katanga — Plateau de Bianco, gare de Bianco, prairie naturelle sur sable, plante à souche charnue à ligneuse, vivace, feuilles en rosette basale, juill. 1955, SCHMITZ 4905; Bianco-hôtel, alt. 1570 m, savane herbeuse sur sable, faible pente, fleurs blanches, sept. 1962, A. SCHMITZ 7817 (holotypus BR); Plateau de Bianco, Grelco, alt. 1600 m, 50 cm de haut, 4 feuilles ras de terre, capitule blanc crème, oct. 1939, QUARRÉ 6136.

This new species belongs to the *Holochili* Briq. It has 4-nate radical greenish leaves and scapes of solitary depressed-globose heads. It grows in the sandy soil of the grassy Bianco plateau.

*Acrocephalus upembensis* Robyns sp. nov.; *A. rosulato* De Wild. similis, sed foliis late ellipticis multo majoribus membranaceisque, capitulis haud congestis et plerumque longe pedunculatis primo visu sat recedit.

*Herba* perennis, erecta, usque ad 30—45 cm alta, rhizomatosa, rhizomate tuberoso-lignoso et in toto 5—7 cm longo, parte profunda napiformi et usque ad 3 cm longa et 1,5 cm lata. Folia omnino basalia, plerumque 4-rosulata, 4—8 mm longe petiolata, petiolo supra canaliculato et praecipue subtus fulvo-

villosus; lamina late elliptica, basi sensim in petiolo attenuata, apice rotundata, marginibus late rotundato-crenatis, 11—19 cm longa et 5—9 cm lata,  $\pm$  membranacea, sicco leviter discolor et pagina inferiore pallidior, nervis lateralibus numerosis, insigniter reticulata, pagina superiore subbullata et pilis sparsis appressis setulosa ad glabrescens, pagina inferiore nervis reticulationeque prominentibus et praecipue in nervis fulvo-villosa. Scapus solitarius, apicem versus 1—2—3 paribus bractearum cum 3—5—7 capitulis cymosis munitus, rotundatus, appresse fulvo-velutinus. Capitula usque ad 10 cm longe pedunculata vel capitulum terminale subsessile, ovoidea, 5—12 mm longa sed plerumque non plane evoluta, omnino fulvo-velutina, multiflora; bracteae extimae deltoideae, obtuse breviterque acuminatae, 5—6 mm longae et latae, submembranaceae, extus dense villosae, ad margines longe ciliatae et intus glabrae; bracteae ceterae exterioribus subsimiles,  $\pm$  rhomboideae, membranaceae, apicem versus sensim reductae. Flores sessiles; calyx 2 mm longus, sub fructu accrescens, tubulosus et apicem versus leviter ampliatus, extus dense longeque villosus, bilabiatus, labiis subaequalibus integris rotundatisque; corolla longe exserta, 6 mm longa; tubus elongatus, cylindricus, apicem versus leviter ampliatus, vulgo 4,5 mm longus glaberque; labrum 3-lobatum cum lobo mediano distincte latiore, extus villosum; labiolum labrum vix superans, apice rotundatum, extus villosum; stamina didynamia, inferiora inserta sed superiora breviter exserta; stylus gracilis, stamina superiora aequans, apice 2-lobulatus. Nuculae juveniles tantum visae.

**Congo:** District of Upper Katanga — Parc National de l'Upemba, Kanonga, alt. 675 m, sous-bois de forêt katangaise à Graminées, févr. 1949, L. VAN MEEL in G. F. DE WITTE 5581 (holotypus BR); Idem, près de Kanonga, forêt katangaise, sur terrain argilo-sablonneux, févr. 1949, L. VAN MEEL in G. F. DE WITTE 5400.

This new species belongs to the *Holochili* Briq. It is easily recognized by the radical rosette of 4-nate large leaves with reticulate nervation and by its velvety-tomentose scapes bearing several cymose and pedunculate flower heads. It occurs in the grassy undergrowth of the savanna forest.

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The genus *Acrocephalus* exhibits a considerable range of habit types, not always easily to recognize on herbarium specimens and therefore not fully exploited in taxonomic treatments. They certainly deserve a detailed ecological study in the field.

The four new species described above have in common a peculiar growth-form and constitute the hemicryptophytic rosulate habit group of the genus, which characterizes also *A. rosulatus* De Wild., *A. kipi-laensis* Robyns and even *A. Homblei* De Wild. They are perennial herbs

with an erect mostly napiform and more or less lignose rhizome, bearing a rosette of basilar leaves and producing scapose flower-heads. All seven belong to the *Holochili* Briq. and occur in the Upper Katanga area. It is here that the genus shows its greatest diversity of growth-forms including the frutescent one and, at the same time, its richest representation in species most of which are moreover endemics (ROBYNS 1931). Upper Katanga with the neighbouring highlands might therefore be regarded as the center of origin of the genus *Acrocephalus* in Africa.

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### Acknowledgement

I am grateful to my collaborator, Dr E. PETIT, for reading the manuscript and for critical suggestions.

### Summary

The main object of this paper is to demonstrate that the African genus *Haumaniastrum* Duvigneaud et Plancke is not sufficiently justified in its present circumscription and cannot be accepted in the absence of a critical revision of *Acrocephalus* Benth.

Further, four new species of *Acrocephalus* are described and recorded for the first time from Upper Katanga, where they are endemics: *A. graminifolius* Robyns, *A. termiticola* Robyns, *A. viridulus* Robyns and *A. upembensis* Robyns.

Finally, it is suggested that *Acrocephalus* may have its center of origin in Upper Katanga and the adjoining highlands.

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## Two New Liliaceae from the Khao Yai National Park

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**Synopsis:** Two new *Liliaceae* from Thailand are described, *Neolourya thailandica* K.L. and *Peliosanthes cumberlegii* K.L. They both belong to the *Peliosantheae* and have the same chromosome number  $2n=36$ .

It was a very happy idea of the nature conservancy of Thailand to declare the Khao Yai mountain massif a national park, and it is, indeed, to be hoped that several scientists in the future will use this excellent opportunity of studying the tropical flora and fauna. The whole area is situated only 150 km from Bangkok and has until recently been a closed land (cp. LARSEN 1964). The dense evergreen jungles covering this isolated area certainly disguise several new species, endemics which have followed their own way of evolution in the presumably long period that they have been separated from their relatives in the other parts of the north-south running mountain range of Burma and central Thailand.

The present two *Liliaceae* were originally thought to be of the same species, as they were collected sterile, but after 9 months of cultivation in the Botanic Garden, Copenhagen, they were both flowering (in April—May 1964), and turned out to be two undescribed species.

### *Neolourya thailandica* sp.nov.

Herba glabra perennis e rhizomate surgens. Quisque caulis basi circiter 7 vaginis apertis sursum crescentibus, viridibus in membranas tenues albas marcescentibus indutus, supra eas folia gerens. Basis folii valida, leniter incrassata, utrinque auri longa membranacea marginata; petiolus 10—16 cm longus; lamina lanceolata, in petiolum sensim transiens, apice acuminata, 9 nervis longitudinalibus validis intermissisque aliis minus validis percursa. omnibus per nervulos transversos crebros anastomosantibus.





Fig. 1. (a)—(e) *Neolourya thailandica*; (a) leaf, (b) inflorescence, (c) flower in side view, (d) longitudinal section of flower, (e) flower where the tepals are cut off. — (f)—(i) *Peliosanthes cumberlegii*; (f) rosette, (g) inflorescence, (h) open flower, (i) longitudinal section of flower.



Flores in racemum dispositi 8 cm longum, basi 5—7 bracteis sterilibus viridibus membranaceomarginatis, 1—2 cm longis, plus minus amplexicaulibus, nervis mediis manifestis in apices uncinatos excurrentibus percursis indutum, in parte inferiore 3 cm longa bracteas steriles gerentem 1 cm distantes, triangulares, 1 cm longas, basi 4 mm latas, omnino virides sicut superiores sursum decrescentes flores cuique unum fulgentes. Axis inflorescentiae teres vel subtiliter sulcatus, glaber. Ex axilla bractee fertilis praeter pedunculum etiam bractea lateralis, triangularis, vestigium fortasse efficiens inflorescentiae partialis cymosae. Pedunculus ca. 5 mm longus, obscure purpureus, sub angulo recto emissus, apice recurvus, florem ita pendulum portans viridipurpureum. Ovarium inferum. Perigonium e duobus verticillis triphyllis compositum; phylla exteriora ovali-lanceolata, basi lata, 5 mm longa, succulenta, dorso sulcata: interiora apice latiora, obovata, paulo breviora. 6 stamina e suo quidque phyllo 1.5 mm supra basin orta, filamentis foliaceis incurvis in coronam connatis antheras in facie interiore portatas orbiculares, ca. 1 mm latas plane obtegentem, quaque per rimam cristiformem longitudinalem aperta. Stylus in helicem tortus, ad stigma versus vix conspicue tripartitum paulum attenuatus. Ovarium triloculum, quoque loculo 2—3—4 ovula fovente. Fructus ignotus (planta culta non fructifera). Numerus chromosomatum  $2n=36$ .

Typus anno 1963 in silva sempervirenti montis Khao Yai in provincia thailandica Prachinburi siti 650 m supra mare ab auctore lectus, in caldario Horti Botanici Hauniensis cultus, anno 1964 florens in alcoholum imissus, in Herbario Universitatis Arhusiensis (AAU) depositus, viva prole in Horto Botanico Hauniensi sub numero KAI LARSEN 10752 culta (Fig. 1 a—e).

This genus has previously been found in the formerly French Indochina, from where 2 species were described by RODRIGUEZ (1934). The present species deviates from the two previously described ones by the corkscrew-formed style, and by a tendency to form more than 2 ovules per locule. From *N. weberi* Rodr., a Tonkinese endemic, it deviates by having an inflorescence much shorter than the petiole, and thus habitually comes closer to *N. pierrei* Rodr. (from Laos and Vietnam); from this it is distinguished by the dorsal furrow of the outer perianth leaves, and by the totally hidden anthers on the curved filaments.

Cytologically it has not previously been studied, but it corresponds with the other members of this tribe (see below). A good metaphase plate is drawn in Fig. 2 a.

### *Peliosanthes cumberlegii* sp. nov.

Herba glabra a rhizomate horizontali confragoso ramificato surgens. Folia rosulata, 4—5 vaginis albidis membranaceis, 1—5 cm longis, nervis mediis validis percursis rosulas basi induentibus. Longitudo folii cum petiolo laminae circiter aequilongo ad 30 cm. Petiolus in sectione transversa D-formis vel triangulus; lamina in petiolum paulum decurrens, lanceolata, acuta, integerrima, 4—5 cm lata, 5 nervis longitudinalibus pervalidis intermissisque 4 minus validis percursa, omnibus per nervulos transversos crebros anastomosantibus.

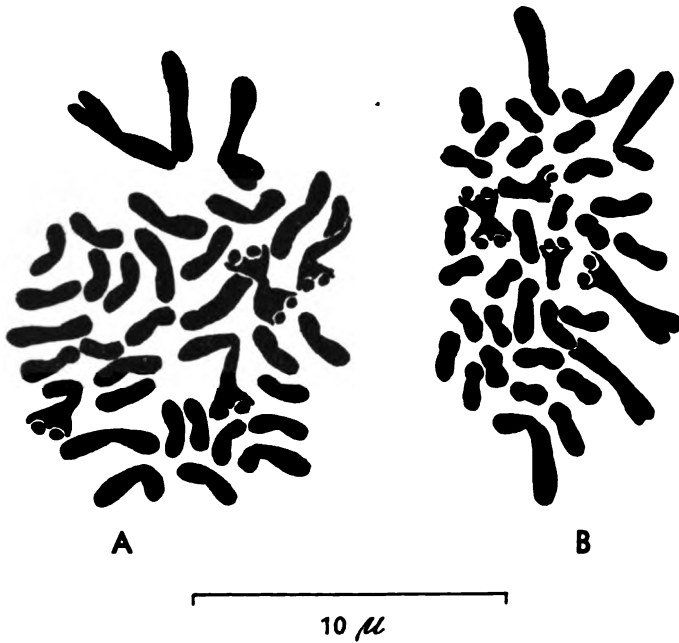


Fig. 2. Root tip metaphases. (A) *Neolourya thailandica*, (B) *Peliosanthes cumberlegii*.  
— The scale is 10  $\mu$ .

Flores in racemum dispositi ab ipsa basi floriferum, 4—7 cm longum, erectum, lateralem, basi 5—6 foliis membranaceis, 1—2 cm longis, lanceolato-obcuneatis mucronatis indutum. Axis inflorescentiae 2 mm crassus, viridi-violaceus, bracteas in helice gerens foliis forma similes, membranaceas, nervis mediis ut apicibus viridibus, inferiores ca. 1 cm longas, superiores paulo breviores. In axilla cuiusque bracteae unus flos pedunculo 5—7 mm longo viridi portatus, et ad basim eius bractea linearis, 3—4 mm longa, acuta, lateralis, fortasse vestigium inflorescentiae partialis cymosae. Flores atro-violacei, 8—10 mm diam. Perigonium epigynum e duobus verticillis triphyllis compositum, phyllis exterioribus 4 mm longis, basi 2 mm latis, ovato-lanceolatis, recurvis, nervis mediis extra viridibus, interioribus paulo brevioribus angustioribus, praeterea similibus. Corona anularis nigra, ca. 1.5 mm alta, 3 mm diam., margine undulata in facie interiore 6 antheras gerens inter se similes, flavas, fissuris longitudinalibus apertas, inter florendum ergo scutella suborbicularia cristis mediis verticalibus carinata revocantes. Ovarium viride, inferum, tribus dissepimentis incompletis, basi in placentam centralem connatis, supra conniventibus inter se liberis loculatum, quoque loculo ovula pauca foveante, stylum apice gerens brevem, conicum, nigrum, stigmate sessili tripartito terminatum. Fructus ignotus. Numerus chromosomatum  $2n=36$ .

Typus in silva sempervirenti montis Khao Yai in provincia thailandica

Prachinburi siti 700—1400 m supra mare a Cumberlege et uxore lectus, in alcoholium immissus, in Herbario Universitatis Arhusiensis (AAU) depositus, viva prole in Horto Botanico Hauniensi sub numero KAI LARSEN 10766 culta (Fig. 1 f—i).

The genus *Peliosanthes* consists of a dozen species ranging from Himalaya down through Malaysia, but it is possible that more intensive collecting in the mountain evergreen forests would reveal several undescribed species. Recently MERRILL (1941) described a new species from Upper Burma, *P. longibracteata*, which is a robust plant with leaves more than 1 m long and 70 cm long racemes. WANG & TANG (1936) in their valuable contributions to the knowledge of the Chinese *Liliaceae* described a new species from Tonkin, *P. tonkinensis* with half a meter long leaves and just as long racemes. The bracts are 2—3 flowered which character is found also in the generic type *P. teta*.

A survey of the other Indochinese species is given by RODRIGUEZ (1934).

Cytologically the genus *Peliosanthes* has previously been studied by SATO (1942) only, who found  $2n=36$  in *P. arisanensis*. This is the same number as was found in the present species (Fig. 2 b) and there is no doubt that the basic number is 18. This number is dominant in certain closely related groups of *Liliaceae*, viz. the *Ophiopogoneae*, the *Aspidistreae*, and the *Peliosantheae*, to which group also *Neolourya* belongs.

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## **The Rediscovery of Two South African Plants and the Renaming of Another**

By W. F. BARKER

Compton Herbarium, National Botanic Gardens, Kirstenbosch, South Africa

“*Ex Africa semper aliquid novi*” is very apt when applied in the botanical sense to South Africa and particularly to the rich floral region of the South Western Cape, which still holds many new and interesting species of plants to be discovered and described. Of even more importance and interest to the South African botanist and monographer however, is the rediscovery of old species collected in South Africa by the early botanical explorers, which have not reappeared again in the course of a century or more.

In recent years access to the early types, mostly preserved in European herbaria, has become easier for them, and work on the new Flora of Southern Africa has stimulated interest in tracing these early species. Where records are complete, with locality and date of flowering, it has already been possible to rediscover many of the plants and to fill in the gaps in our knowledge of the genera and species, but in cases where no details were recorded, their rediscovery has had to be left to chance, and when they do come to light it is an event of some importance and great satisfaction.

As part of the Golden Jubilee Celebrations of The National Botanic Gardens, Kirstenbosch, in 1963, a number of Botanists from all over the world were invited to South Africa to take part in the events planned to mark the occasion. In September a short tour to Namaqualand was arranged to give them the opportunity of seeing the spring floral display which is unique. Among the distinguished guests was Professor TYCHO NORLINDH, who had already visited South Africa on a former occasion.

On this journey, stops along the road were made as often as time

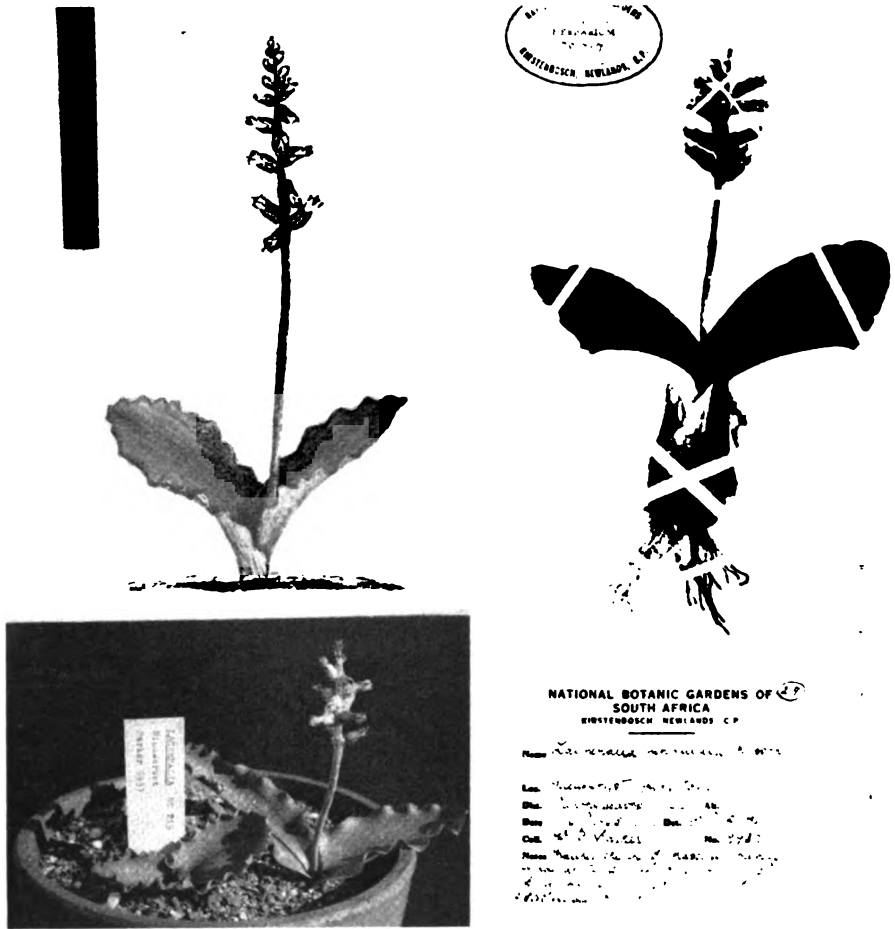


Fig. 1. *Lachenalia undulata* Masson ex Bak. Photographs. — Upper left: Masson's type drawing in the British Museum (Natural History). — Lower left: Plants grown at Compton Herbarium of BARKER 9937, from Nieuwerus, Vnrhynsdorp Div. C.P. — Right: Sheet in Compton Herbarium of BARKER 9937.

allowed, to give the party an opportunity to photograph and study the flora. One of these halts was made near the small town of Nieuwerus (Nieuwerust), in the Vnrhynsdorp Division of the Cape Province, before entering Namaqualand proper. On the roadside verge sparsely covered with low vegetation, I collected some bulbs in leaf of what appeared to be an unfamiliar species of *Lachenalia*. These were grown in a pot at the Compton Herbarium, Kirstenbosch and when they

flowered on 1st June 1965, they proved to match exactly MASSON's painting in the British Museum of his *Lachenalia undulata*, the probable date of which is 1793. This original painting is the holotype of the species published by BAKER in Journ. Bot. 1886. It has not been reproduced before and is published here by permission of the British Museum authorities. Accompanying it are photographs of the localized specimens, BARKER 9937, from Nieuwerus for comparison. One of the bulbs was pressed and preserved in the Compton Herbarium and the emended description was made from it.

The only other collection known to exist which matches MASSON's figure, is in the Bolus Herbarium, University of Cape Town. It is a single specimen without a bulb, numbered NBG 1065/15, collected by A. ST. C. CAPORN, and was preserved without details as to locality or date of flowering. However on consulting the register in the National Botanic Gardens, Kirstenbosch, the locality under that number was given as Garies, Namaqualand, which is about 50 miles north of Nieuwerus, in Namaqualand proper. It is possible when specimens in European herbaria are carefully studied other collections may come to light, but the one from Nieuwerus is the first to be recorded with certainty in its native habitat.

1. *Lachenalia undulata* Masson ex Bak. in Journ. Bot. 1886: p. 336; BAK. in Fl. Cap. 6: p. 427; non sensu BARKER in Fl. Pl. S.A. Pl. 431 1931.

Bulb globose 2.5 cm. diam. covered with papery brownish scales, produced into a neck up to 2 cm. long. Leaves two, oblong obtuse, suberect to spreading, undulate towards the margins, glabrous, without markings but with depressed longitudinal veins on the upper side, 7.5 cm. long, 3 cm. broad. Peduncle 11 cm. long. Inflorescence 5 cm. long. Flowers sessile, spreading, 1 cm. long; outer segments 7 mm. long, tinged with green; inner segments white, tinged with claret purple. Stamens as long as the inner segments (not the outer as stated by BAKER, as they are quite evident in the painting) and exceeding them in the older flowers.

Holotype: MASSON's drawing at the British Museum.

Flowering period: June.

Vanrhynsdorp: Near town of Nieuwerus; BARKER 9937 (NBG).

Without Locality: NBG 1064/15, A.ST.C.CAPORN (BOL), locality in Register of Nat. Bot. Gardens, Kirstenbosch: Namaqualand, Garies.



Fig. 2. *Lachenalia framesii* Barker. — Painting by W. F. BARKER of the type, P. ROSS-FRAMES, Bolus Herbarium No. 19614, 20 miles N. of Vanrhynsdorp C.P.

Before seeing the photograph of MASSON's type drawing, my painting of another plant was published in 1931 in *The Flowering Plants of S. Africa* Plate 431, with a description in English only, under the name *Lachenalia undulata* Masson ex Baker. It is now quite clear that it does not agree with it and will have to be renamed and validated with a Latin description.

2. *Lachenalia framesii* Barker sp.nov.

*Lachenalia undulata* sensu Barker in *Fl.Pl. of S.A.* Vol. 2, Pl. 431, 1931.

**Bulbus** parvus globosus. **Folia** 1—2, erecta vel recurvata, lanceolata acuta, saturate viridia, marginibus undulatis, 7.5—10 cm. longa, 1—1.5 cm. lata. **Pedunculus** 9 cm. longus, 2—3 mm. diam. **Spica** 5 cm. longa, 2 cm. diam. 10—20-floris. **Flores** adscendentes, segmentis exterioribus oblongis, laete luteo viridibus, prope apicem viride tinctis, 8 mm. longis; segmentis interioribus 1 cm. longis, lateralibus inferne luteo viridibus, parte superiore tertia viride, deinde saturate purpurea, inferiore angustiore, alba, parte superiore tertio purpurea. **Stamina** declinata, segmentis exterioribus aequilonga. **Stylus** albus stamina aequans; stigma minutum.

**Bulb** small globose. **Leaves** 1—2, erect or recurved, lanceolate acute, dark green, margins undulate, 7.5—10 cm. long, 1—1.5 cm. broad. **Peduncle** 9 cm. long, 2—3 mm. diam. **Spike** 5 cm. long, 2 cm. diam. 10—20 flowered. **Flowers** ascending, outer segments oblong, bright yellow green, tinged with green near the apex, 8 mm. long; inner segments 1 cm. long, recurved at the apex, the lateral yellow green below, the upper third green shading to dark purple; the lower narrower, white, with the upper third purple. **Stamens** declinate as long as the outer segments. **Style** white, as long as the stamens; stigma minute.

**Holotype:** P. ROSS-FRAMES in Bolus Herbarium No. 19614.

**Flowering period:** July—Aug.

**Vanrhynsdorp:** 20 miles north of Vanrhynsdorp, P. ROSS-FRAMES, Bolus Herbarium No. 19614 (BOL); Zandkraal, W. F. BARKER 5666 (NBG), A. M. WILMAN 873 (BOL); Trekkersdraai, 39 miles NNW of Vanrhynsdorp, J. P. H. ACOCKS 19395 (PRE and NBG); Knechtsvlakte, NBG 1113/48 (NBG), COMPTON 20687 (NBG), BARKER 6596 (NBG).

**Calvinia:** Nieuwoudtville, H. BUHR, NBG 1542/30 (BOL).

Since the plant was described and illustrated in 1931 a number of collections have been made, widening its known range of distribution. It has also been noted that in a favourable season the plants tend to be taller and the leaves broader than those of the type collection.



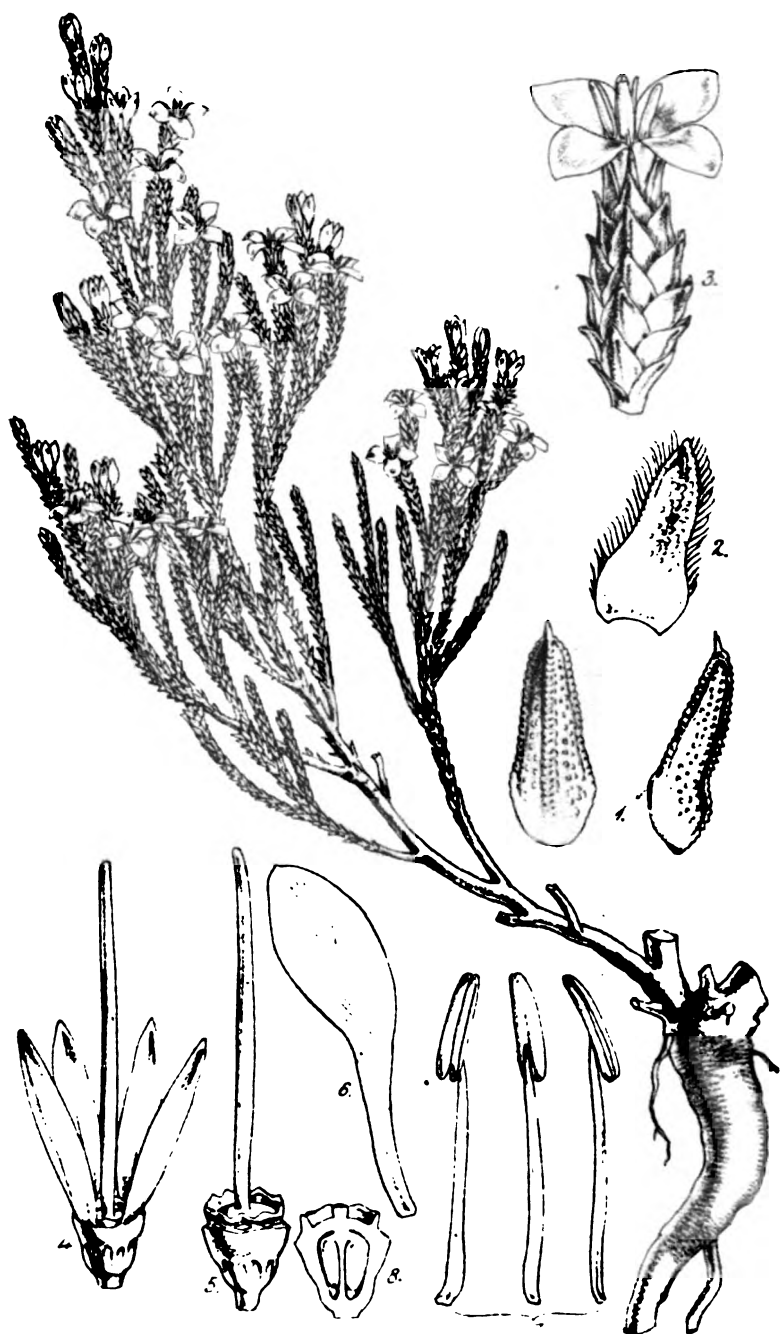


Fig. 3. *Thamnea hirtella* Oliver (*Thamnea uniflora* Sol. var. *hirtella* Oliv.) — Illustration in HOOK. Ic. Pl. XI, 9, tab. 1013, of BURCHELL's type 8655.

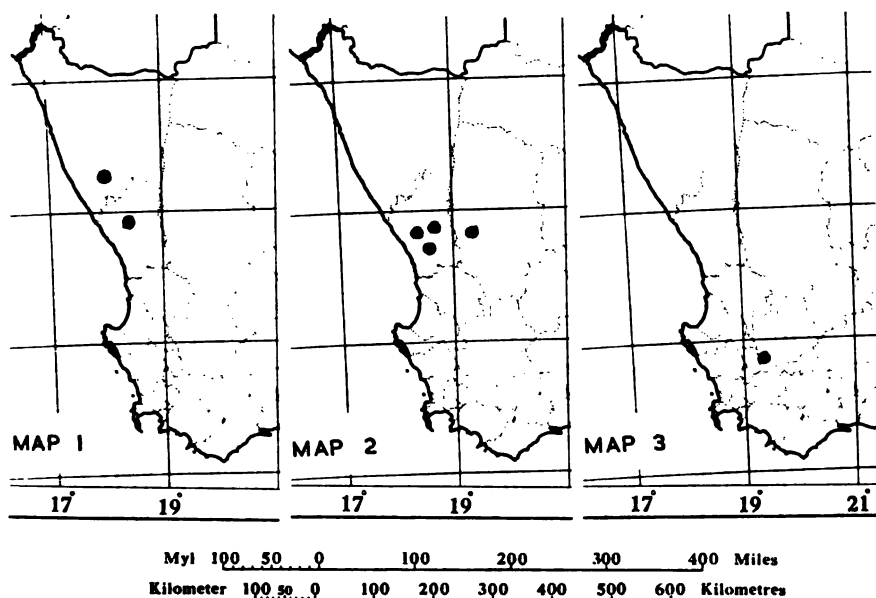


Fig. 4. The distribution of *Lachenalia undulata* (Map 1), *Lachenalia framesii* (Map 2), and *Thamnea hirtella* (Map 3).

While J. P. H. ACOCKS mentions that the plant at Trekkersdraai was rare, BARKER 5666 occurred in large numbers on the flats at Zandkraal and WILMAN 873, "seen in large sheets several feet across", was collected in the same area.

The species is named in honour of Mr. P. ROSS-FRAMES who took a great interest in the South African Flora for many years, and cultivated many indigenous species in his garden at Kenilworth, Cape Town.

3. *Thamnea hirtella* Oliver in Journ. Linn. Soc. Bot. IX, 332 (1867); DUMMER in Journ. Bot. L. Suppl. 2, P. 18 (1912); *T. uniflora* Sol. var. *hirtella* Oliver in HOOK. Ic. Pl. XI, 9, tab. 1013 (1867—71); *Schinzafra hirtella* O. Kuntze, Revis. Gen. Pl. I, 234 (1891).

Holotype: BURCHELL 8655 (K).

Flowering period: April—June.

Tulbagh: Witzenberg, BURCHELL 8655 (K), H. B. RYCROFT 2711 (NBG).

Another interesting plant was rediscovered by Professor H. B. Ry-

CROFT on 1st June 1963. It is *Thamnea hirtella* Oliver published in Journ. Linn. Soc. Bot. IX, 332 (1867) and illustrated in HOOK. Ic. Pl. XI, 9, tab. 1013 (1867—71) as *Thamnea uniflora* Sol. var. *hirtella* Oliv. It had been previously known only from BURCHELL's type specimen 8655 in the Kew Herbarium, collected on 20th April 1811 on the Witzenberg, Tulbagh Division, Cape Province. See 'Sketch Map of Burchell's Trek' by M. MCKAY in Journ. S. A. Bot. Vol. IX Pt. II 1943, p. 31.

There is a small portion of this type in the Bolus Herbarium, University of Cape Town, which was used by N. S. PILLANS when doing his revision of the *Bruniaceae* in Journ. of S. A. Bot. Vol. XIII Pt. III 1947, p. 145, and it is the only specimen which he cited when he restored it to its original name.

H. B. RYCROFT 2711 was collected quite by chance, in what was probably the type locality, on the Witzenberg Range, Tulbagh Div., Cape Province, at an altitude of 4000 ft. Professor RYCROFT describes it as growing on the summit of the mountain towards the northern side. Locally frequent, the rounded bushes were from 18"—2 ft. in height and quite conspicuous when in flower. As the specimens were in the early flowering stage, no fruits were available and these still remain to be collected and described.

### Summary

Due to the discovery in 1963, of plants of *Lachenalia undulata* Masson near Nieuwerus, in the Vanrhynsdorp District of the Cape Province, it has been possible to identify and localize the species, known previously only from MASSON's drawing in the British Museum, which was probably executed in 1793. This has necessitated the publication of the new species *Lachenalia framesii* Barker, which had formerly been misidentified as *L. undulata* Masson, and illustrated under that name in the Flowering Plants of South Africa Pl. 431 1931.

The first collection in 1963 of specimens of *Thamnea hirtella* Oliver on the Witzenberg, in the Tulbagh District of the Cape Province, since BURCHELL found it there in 1811, has confirmed that the little known and interesting plant is still extant and available for further study.

## A Contribution towards the Economic Botany of Basutoland

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In a country as mountainous and as densely populated as Basutoland, with relatively little arable land and a very small average cash income per annum per person, the use by the peasants of wild plants and weeds to supplement their ordinary diet, is important. Such use has two main benefits: one, the actual amount of food is increased; two, the otherwise monotonous and limited starchy diet is improved by the addition of green foodstuffs and vitamin-containing fruits. It is not always laziness that makes a peasant farmer leave certain plants untouched when cultivating the fields. As the land is the property of the nation, anyone may, with certain restrictions, gather wild food plants anywhere, as, for example, in fallow fields or grazing areas, but not where crops have been planted, nor where a fence has been put up. There are, however, few fences in Basutoland, except round the small vegetable gardens near huts, so that the wild plants are a ready source of food-stuffs for everyone willing to make the effort to gather them.

Recently, such wild herbs have become common articles for sale in the small markets which now exist in the district centres, and one sees, alongside cabbages, onions, tomatoes, basins full of wild greens or pot-herbs, though the wild fruits, such as those of species of *Rubus* are less often sold.

A source of food not much used, through fear of poisoning, is the fungi, though there is a number of edible indigenous and imported fungi in the country; generally only those of Nguni stock, i.e. not true Basotho, eat fungi of any sort. One fern, *Marsilea macrocarpa*, is used occasionally as a pot-herb. There are no indigenous gymnosperms and the use of the seeds of the planted pine trees has not yet been recognised.

Table

Name	Part	How used
<b>Non-angiosperms</b>		
<i>Psalliotia</i> spp.	fruiting body	stewed
<i>Termitomyces</i> sp.	fruiting body	stewed
<i>Marsilea macrocarpa</i>	leaves, petioles	pot-herb
<b>Angiosperms (alphabetically according to family and genus)</b>		
<b>Dicotyledons</b>		
<b>ANACARDIACEAE</b>		
<i>Rhus dentata</i>	fruits	raw
<b>ASCLEPIADACEAE</b>		
<i>Asclepias multicaulis</i>	leaves, roots	raw
	leaves	pot-herb
<i>Asclepias</i> spp.	roots	raw
<i>Pachycarpus</i> spp.	leaves	pot-herb
	roots	raw
<i>Riocreuxia torulosa</i>	leaves	pot-herb
<i>Schizoglossum</i> spp.	roots	raw
<b>AMARANTHACEAE</b>		
<i>Amaranthus paniculatus</i>	young shoots	pot-herb
<i>Amaranthus thunbergii</i>	young shoots	pot-herb
<b>CAMPANULACEAE</b>		
<i>Lobelia</i> spp.	young plants	pot-herb
<i>Wahlenbergia androsacea</i>	young plants	pot-herb
<i>Wahlenbergia</i> spp.	young plants	pot-herb
<b>CARYOPHYLLACEAE</b>		
<i>Cerastium capense</i>	young plants	pot-herb
<i>Pollichia campestris</i>	fruits	raw
<b>CHENOPODIACEAE</b>		
<i>Chenopodium album</i>	young shoots, leaves	pot-herb
<b>COMPOSITAE</b>		
<i>Athrixia elata</i>	leaves	boiled; as tea
<i>Berkheya</i> spp.	young leaves	pot-herb
<i>Gazania</i> spp.	flowerheads	raw
<i>Lactuca capensis</i>	young plants	pot-herb
<i>Metalsia muricata</i>	leaves	boiled; as tea
<i>Sonchus</i> spp.	young plants	pot-herb
<i>Taraxacum</i> spp.	young plants	pot-herb
<i>Tragopogon porrifolius</i>	young leaves	pot-herb
<b>CONVOLVULACEAE</b>		
<i>Ipomoea crassipes</i>	roots	raw
<b>CRUCIFERAE</b>		
<i>Lepidium</i> spp.	young plants	pot-herb
<i>Rorippa</i> spp.	young plants	pot-herb
<i>Rorippa nasturtium-aquaticum</i>	all parts	raw
( <i>Nasturtium officinale</i> )	all parts	pot-herb
<i>Sisymbrium</i> spp.	young plants	pot-herb
<b>CUCURBITACEAE</b>		
<i>Cucurbita</i> spp.	young shoots mixed with young fruits	pot-herb
<b>EBENACEAE</b>		
<i>Euclea</i> spp.	fruits	raw
<b>ERICACEAE</b>		
<i>Erica cerinthoides</i>	flowers	sucked for nectar

Name	Part	How used
<b>EUPHORBIACEAE</b>		
<i>Clusia pulchella</i>	crushed plant	to thicken milk
<i>Euphorbia clavarioides</i>	latex, dried	as 'chewing gum'
<i>Euphorbia striata</i>	roots	flavouring for milk
<b>GERANIACEAE</b>		
<i>Geranium incanum</i>	leaves	boiled; as tea
<i>Pelargonium</i> spp.	leaves	raw
	roots	meal for porridge
<b>HALORRHAGIDACEAE</b>		
<i>Gunnera perpensa</i>	petioles	raw; also for making beer
<b>LABIATAE</b>		
<i>Leonotis</i> spp.	flowers	sucked for nectar
<i>Mentha longifolia</i>	leaves	boiled; as tea
<b>LEGUMINOSAE</b>		
<i>Argyrolobium tuberosum</i>	roots	raw
<i>Dolichos angustifolia</i>	roots	raw
<i>Elephantorrhiza burchellii</i>	seeds	roasted; as coffee
<i>Gleditsia triacanthos</i>	fruits	raw
<i>Rhynchosia</i> spp.	roots	raw
<i>Trifolium</i> spp.	inflorescences	raw
<b>ONAGRACEAE</b>		
<i>Epilobium hirsutum</i>	leaves	sucked (salty taste)
<b>OXALIDACEAE</b>		
<i>Oxalis</i> spp.	leaves, flowers	raw
<b>PAPAVERACEAE</b>		
<i>Papaver aculeatum</i>	young plants	pot-herb
<b>POLYGONACEAE</b>		
<i>Rumex</i> spp.	leaves	raw
<b>PORTULACACEAE</b>		
<i>Portulaca oleracea</i>	young plants	pot-herb
<b>RANUNCULACEAE</b>		
<i>Thalictrum caffrum</i>	young plants	pot-herb
<b>ROSACEAE</b>		
<i>Rosa rubiginosa</i>	fruits	raw
<i>Rubus</i> spp.	fruits	raw
<b>SCROPHULARIACEAE</b>		
<i>Diascia</i> spp.	young plants	pot-herb
<i>Halleria lucida</i>	flowers	sucked for nectar
	fruits	raw
<i>Nemesia</i> spp.	young plants	pot-herb
<b>SOLANACEAE</b>		
<i>Physalis viscosa</i>	fruits	raw
<i>Solanum</i> spp.	fruits	to thicken milk
<i>Solanum nigrum</i>	fruits	raw
	young shoots	pot-herb
<b>URTICACEAE</b>		
<i>Urtica</i> spp.	young stages	pot-herb
<b>VITACEAE</b>		
<i>Rhoicissus cuneifolia</i>	fruits	raw
<b>ZYGOPHYLLACEAE</b>		
<i>Tribulus terrestris</i>	leaves	pot-herb
<b>Monocotyledons</b>		
<b>AMARYLLIDACEAE</b>		
<i>Forbesia plicata</i>	tuberous stock	raw
<i>Hypoxis</i> spp.	tuberous stock	raw

Name	Part	How used
ARACEAE		
<i>Zantedeschia aethiopica</i>	leaves, petioles	pot-herb
CYPERACEAE		
<i>Cyperus usitatus</i>	'bulb'	raw; roasted
GRAMINEAE		
<i>Eleusine africana</i>	grains	meal (in famine)
<i>Eragrostis</i> spp.	grains	meal (in famine)
<i>Haemarthria altissima</i>	rhizome base	raw
<i>Imperata cylindrica</i>	rhizome base	raw
<i>Miscanthidium sorghum</i>	rhizome base	raw
IRIDACEAE		
<i>Gladiolus cruentus</i>	flowers	raw and as pot-herb
<i>Gladiolus ecklonii</i>	flowers	raw and as pot-herb
<i>Hesperantha</i> spp.	corms	raw
<i>Moraea</i> spp.	corms	raw
<i>Watsonia lepida</i>	flowers	sucked for nectar
JUNCACEAE		
<i>Juncus</i> spp.	rhizome base	raw
LILIACEAE		
<i>Anthericum</i> spp.	swellings on roots	raw
<i>Asparagus</i> spp.	young shoots	raw and as pot-herb
<i>Dipcadi viride</i>	bulb and leaves	pot-herb
<i>Galtonia viridiflora</i>	bulb	? pot-herb
<i>Kniphofia</i> spp.	flowers	sucked for nectar
<i>Tulbaghia</i> spp.	whole plant	pot-herb
ORCHIDACEAE		
<i>Neobolusia</i> spp.	tubers	raw

Among the angiosperms, both indigenous and introduced plants are used, and the table accompanying this gives a list of most of the more important non-cultivated food plants.

Some of the wild foodstuffs gathered come from plants generally considered poisonous elsewhere, as, for example, the use of the dried latex of *Euphorbia clavarioides* as a kind of 'chewing gum', or the use of *Solanum nigrum* berries as fruit to eat raw, and the leaves as a pot-herb. In this latter case, the author considers that '*Solanum nigrum*' in Southern Africa consists of several different species or varieties of *Solanum*, none, or only one, of which may be *Solanum nigrum* of the Northern hemisphere. Generally, the Basotho are experienced in recognizing and distinguishing by name, harmless and harmful plants, but occasional cases of poisoning occur, usually among small children who have dug up roots, corms or bulbs to eat. Among adults, plant poisoning is usually the result of medicinal use of herbs.

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## ***Crassula bloubergensis* sp. nov.**

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*Crassula bloubergensis* R. A. Dyer, sp.nov., *C. setulosae* Harv. affinis sed foliis carnosis bruneo-rubris glabris vel minute ciliatis differt.

Planta succulenta humilis perennis caespitosa usque 6 cm alta. Folia basilaria rosulata connata carnosae, circiter 1 cm longa, 4 mm lata, 2—2.5 mm crassa, supra leviter concava infra convexa nonnunquam pilis minutis ciliata. Scapi terminales gracillimi, 4—6 cm alti, plusminusve minute papillato-pubescentes, internodiis 3—6, bracteis instructi: bracteae foliaceae superiores minores. Pedicelli 2 cm longi. Sepala basi connata, lanceolata vel ovato-lanceolata, 2—3 mm longa. Petala basi connata, oblonga, obtusa, 4—5 mm longa, 1.5—1.75 lata, superne recurva, infra apicem dorso mucronulata. Stamina quam petala breviora filamentis gracilibus. Carpodia 3—3.5 mm longa, ovariis obliquo-ovalibus stylis aequilongis. Squamae subquadratae carnosae 0.5 mm longae.

**South Africa.** Transvaal: Pietersburg District; on top of Blouberg near Trig. Beacon, shallow sandy soil over quartzite rocks, forming mats, 6,700 ft., Codd & Dyer 9036 (PRE, holotype); Streyl & Schlieben 8483 (PRE).

Dwarf succulent plant freely branched at the base into small mats, from which flowering branches arise up to 6 cm tall. Leaves in basal rosettes, pale olive-green tinged with maroon, about 1 cm long, 4 mm broad, 2—2.5 mm thick, narrowed to both ends, obtuse, flat or slightly concave above, convex on under surface, sometimes with a few small cilia and with faint markings under the surface. Flowering stems 4—6 cm tall, slender, minutely papillate-pubescent, with 5—7 pairs of leafy bracts; bracts similar to leaves but diminishing in size upwards on scape; inflorescence cymose, 3—12-flowered; pedicels 2 cm long. Sepals indian-lake in colour, very shortly united, succulent, lanceolate to ovate-lanceolate, 2—3 mm long, subobtuse, glabrous or with few minute hairs. Petals La France pink (R.C.S.), united at base, oblong, obtuse, 4—5 mm long, 1.5—1.75 mm broad, recurved in



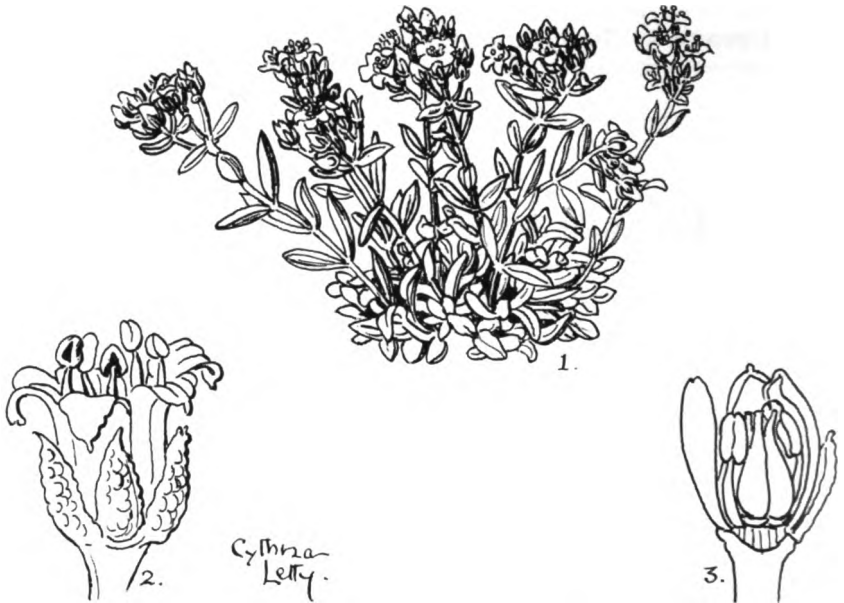


Fig. 1. *Crassula bloubergensis* R. A. Dyer. 1, plant, natural size; 2, flower,  $\times 5$ ; 3, longitudinal section of bud,  $\times 5$ .

the upper third with a small mucro behind the apex. Stamens with slender filaments 3 mm long. Carpels 3—3.5 mm long, with ovary and style nearly equal in length, light rose doree in colour: stigma minute, obliquely truncate; squamæ subquadrate, 0.5 mm long, deep rose doree in colour.

The affinity of this species, which I describe to commemorate the 60th birthday of my personal friend TYCHO NORLINDH from the land of LINNAEUS and THUNBERG, is with *C. setulosa* Harv. and its allies. In his work entitled 'Materials for a Critical Revision of Crassulaceae'. SCHONLAND (in Trans. Royal Soc. S. Afr. 17, 1929) established 7 varieties of *C. setulosa*. Some of these varieties had previously been afforded specific status. Specific status is likely to be restored in certain cases when a complete revision is undertaken in the light of considerable additional material and information.

*C. bloubergensis* differs from all members of this *C. setulosa* alliance in its more succulent, maroon-coloured leaves and bracts which are glabrous except for a few minute cilia on the margins.

The Blouberg (earlier spellings Blaauwberg, Blauwberg) is an isolated mountain rising abruptly from the plains of the north-western Transvaal. Our species occurs near the beacon indicating the summit at about 6,700 ft. altitude. It forms small matted tufts in rock crevices and comes into flower towards the end of January and continues to flower throughout February and into March. In this mountain habitat rain and clouds are likely to afford moisture for the greater part of the year and the plants are rarely subjected to intense drought conditions of long duration.

## Utvecklingshistoriska och limnologiska observationer i Ranviken av sjön Immeln

Av GUNNAR DIGERFELDT

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Sedan några år tillbaka har författaren varit sysselsatt med en utvecklingshistorisk undersökning av Ranviken — en vik av sjön Immeln i nordöstra Skåne. I denna uppsats, som endast skall betraktas som ett förelöpande meddelande, kommer en redogörelse att lämnas för några borringar, utförda i rekognoscerande syfte i begynnelsen av ovan nämnda undersökning.

Ranviken är tvivelsutan mest bekant som den sist kända lokalen för spontant förekommande *Trapa natans* L. (sjönöt) i Sverige. De undersökningar, som viken har varit och kommer att bli föremål för, har självklart till en del sin motivering i de upplysningar, som genom dem kan erhållas om sjönötens uppträdande under allra yngsta postglacial tid, innefattande också historisk tid. Resultaten av den limnologiska undersökning författaren utfört av viken, som ett litet bidrag till kännedomen om sjönötens ekologi, kommer också att meddelas i denna uppsats.

### Allmän beskrivning

Ranviken kan, som framgår av kartan fig. 1, uppdelas i en yttre, långsmal del, här kallad Ransundet, och en inre, närmast kvadratisk utvidgad del. Viken ligger väl skyddad av omgivande höga, barrskogsklädda moränkullar. Sedimentationsförhållandena är, som en följd av det skyddade läget, synnerligen gynnsamma. Även på grunt vatten inom strandnära områden utgöres botten av organogen, något dyigt gytta. Inom den inre, egentliga Ranviken förekommer minerogen botten endast inom mycket begränsade områden.

Stranden är inom den södra delen av Ranviken mycket brant och

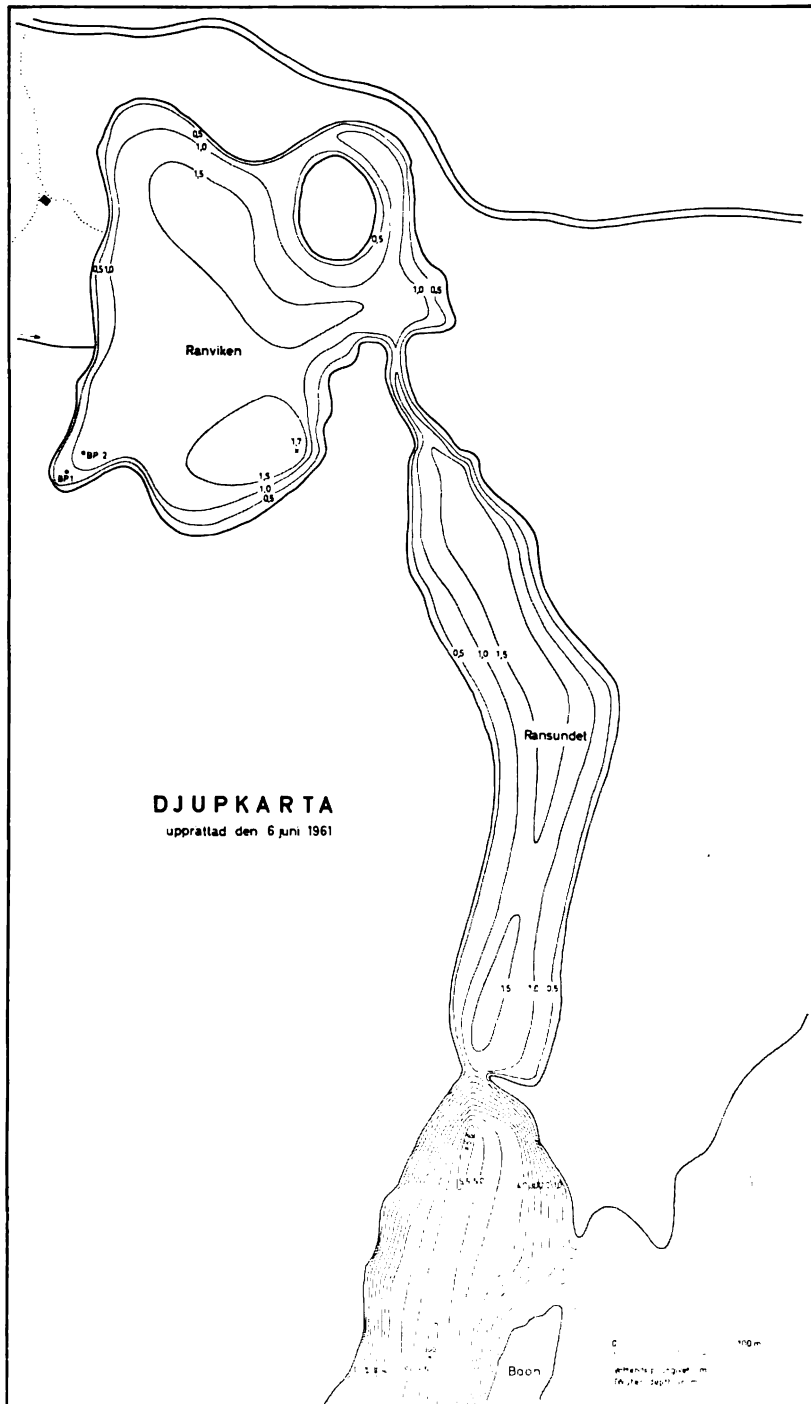


Fig. 1.

blockrik samt mestadels skogbevuxen nästan ända ner till vattenbrynet, inom övriga områden långsluttande och vanligen upptagen av mer eller mindre *Sphagnum*-rika kärrmarker.

Enda tillöppet utgöres av en från en numera utdikad torvmark kommande liten bäck, som mynnar på den västra stranden.

Djupförhållandena framgår av den upprättade djupkartan fig. 1, som grundar sig på ca 150 lodningar utförda i juni 1961 (vattenytan enligt avvägning från fixpunkt vid detta tillfälle 81,1 m ö.h.). Den inre, egentliga Ranviken är förhållandevis grund med en flackt skålformad botten. Största uppmätta djupet i viken uppgår till 1,7 m. En endast ca 10 m bred och 1 m djup passage utgör förbindelsen med det utanför liggande, likaledes grunda och flacka Ransundet. Först utanför dettas mynning i Immeln har större djup uppmäts. Bäckentopografiskt skiljs Ranviken, Ransundet och övriga Immeln genom väl markerade morän-trösklar.

### Limnologisk undersökning

Det var år 1871 som några botaniserande skolynglingar påträffade sjönöten växande i Ranviken (NORDSTEDT 1871 s. 134 f.). Då arten, sedan den någon gång under början av 1800-talet dött ut i Hemsjön (tidigare även kallad Sulegångssjön), Misterhults socken i Kalmar län, länge hade antagits inte längre förekomma spontant i Sverige, väckte fyndet helt naturligt en inte så ringa uppmärksamhet. Sjönöten växte vid tiden för upptäckten inom den nordöstligaste delen av viken (fig. 2) samt vidare inom begränsade områden av vikens sydvästliga del (MALMSTRÖM 1915 s. 76). Med streckad linje har på vegetationskartan fig. 3 markerats de områden, inom vilka rikligt med väl bevarade frukter påträffats vid bottenskrapning, som omfattat de 10—15 översta cm av gyttjan. Detta område kan på goda grunder anses representera sjönötens utbredning vid tiden för upptäckten. Enligt MALMSTRÖM (l.c.) förekom sjönöten de första åren efter upptäckten tämligen talrikt (40—50 ind. årligen) men dock i för vart år successivt avtagande antal. Efter år 1900 utvecklades sålunda sällan mer än ett 10-tal ind. varje sommar. Sista året arten iakttogs (1913) förekom den i ett enda, dåligt utvecklat ind. i viken längst i sydväst.

Ute i Ransundet har sjönöten troligen inte förekommit — åtminstone inte i rikligare mängd — varken i sen tid eller under tidigare perioder. Såväl företagna borrhningar som bottenskrapningar har här givit negativt resultat.



Fig. 2. Nordöstra delen av inre Ranviken. Ön syns till höger. — *The north-eastern part of the inner Ranviken Bay. The island is seen to the right.*

Under de ca 50 år som förflutit efter sjönötens utdöende, har några nämnvärda förändringar av miljöförhållandena i Ranviken säkerligen inte inträffat, om man undantager strand- och sjövegetationens något ökade utbredning, orsakad av den fortskridande uppgrundningen. Kulturbetingad påverkan har inte förekommit, bortsett från den reglering av Immelns vattenstånd som på senare tid företagits. Den limnologiska undersökningen är, som tidigare framhållits, avsedd att utgöra ett litet bidrag till kännedomen om sjönötens ekologi.<sup>1</sup> En del är visserligen redan känt härom (jfr bl.a. APINIS 1940 samt där cit. litteratur), mycket därav dock tyvärr av alltför allmän karaktär för att kunna bilda en säker grundval för en diskussion om de olika faktorer — utöver de klimatiska — som kan tänkas vara av betydelse för sjönötens existens och utbredning. Den limnologiska undersökningen har omfattat analys av några viktiga kemiska och fysikaliska vattenegenskaper, vidare inventering och kartläggning av vikens makrofytvegetation.

<sup>1</sup> En beskrivning av Immeln har tidigare lämnats av ALMESTRAND (1957). Beskrivningen gäller dock Immeln i stort. Förhållandena inne i vikarna, däribland Ranviken, är i flera avseenden avvikande.

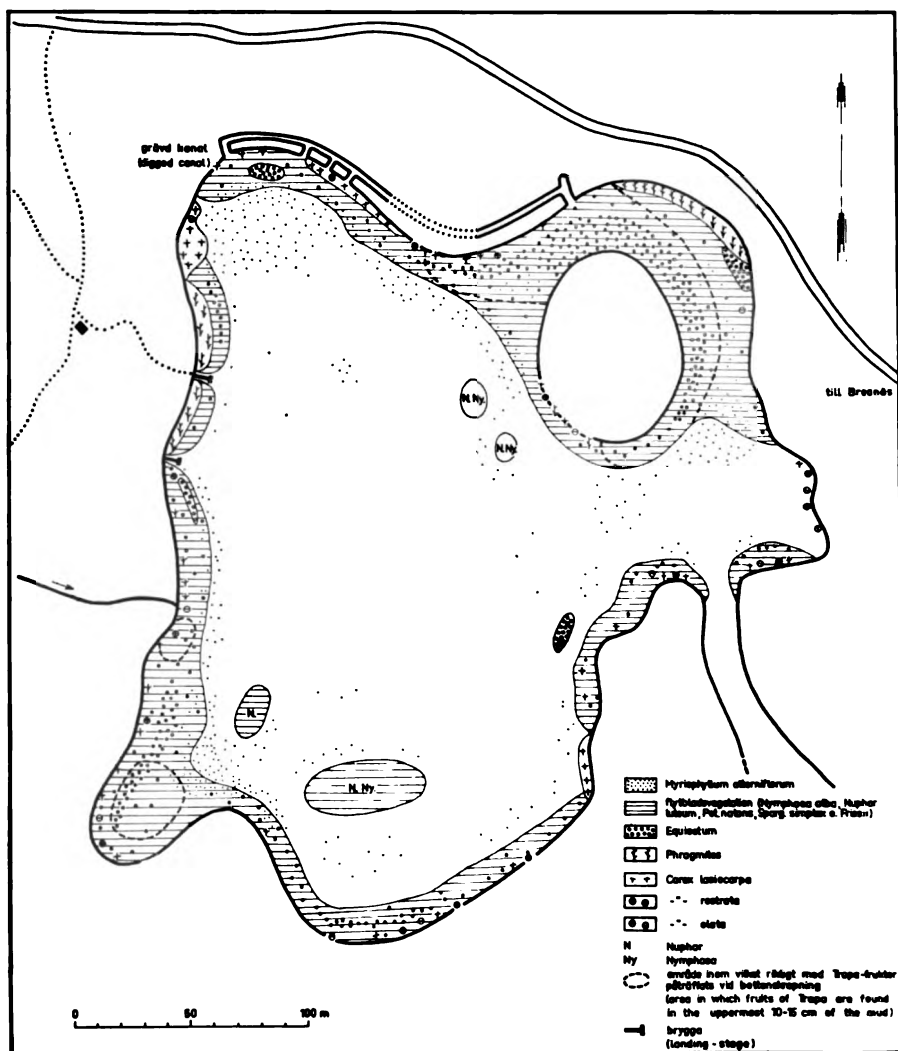


Fig. 3.

**Vegetationsförhållanden.** Inventeringen utfördes i juni 1960. I den följande redogörelsen hänvisas till den vegetationskarta, som då upprättades (fig. 3).

Helofytisktiktet: *Calla palustris*, *Carex elata*, *C. lasiocarpa*, *C. rostrata*, *Eleocharis palustris*, *Equisetum fluviatile*, *Lysimachia thyrsiflora*, *Meyanthes trifoliata*, *Peucedanum palustre*, *Phragmites communis*, *Potentilla palustris*.

**Nymphaeidskiktet:** *Nuphar luteum*, *Nymphaea alba*, *Potamogeton natans*, *Sparganium simplex* f. *longissimum*, *Sp. Friesii*.

**Elodeidskiktet:** *Hottonia palustris*, *Juncus alpinus* ssp. *nodulosus*, *J. bulbosus*, *Myriophyllum alterniflorum*, *Utricularia intermedia*.

**Isoetidskiktet:** *Littorella uniflora*, *Lobelia dortmanna*, *Ranunculus reptans*.

Ranvikens belägenhet inom ett av urbergsmorän dominerat och på växtnäringssämnen fattigt område präglar sjövegetationen. Antalet påträffade arter är ringa och artsammansättningen till sin utformning oligotrofi-indicerande. På grund av det ringa vattendjupet samt förekomsten även inom de strandnära områdena av organogen gyttja som underlag är dock såväl helofyt- som nymphaeidvegetationen i kvantitativt avseende dock tämligen väl utvecklad. Inom den förstnämnda dominerar helt *Equisetum fluviatile*, som förekommer antingen i form av täta vassar med begränsad utbredning eller som en några meter från stranden förlöpande bård. De få *Phragmites*-vassar som finns är förhållandevis glesa och lågvuxna.

Nymphaeidskiktet upptager inom de nordöstra samt sydvästra delarna av viken betydande områden. I övriga delar förekommer flytbladsväxterna inom en 10—15 m bred zon närmast utanför stranden, här och var avbruten av täta *Carex lasiocarpa*-vassar. *Nymphaea* och *Nuphar* påträffas även inom begränsade områden mitt ute i viken.

Bland elodeiderna är *Myriophyllum alterniflorum* den mest företrädade arten. Den förekommer ställvis i riklig mängd inom en relativt smal zon utanför samt i utkanten av nymphaeidbältet.

Isoetiderna har inom viken som en följd av även på grunt vatten rådande ogynnsamma ljusförhållanden — tät påvattens- och övervattensvegetation, humusfärgat vatten — en mycket begränsad utbredning och förekommer endast sparsamt på den minerogena botten i viken sydöst om Ranön.

**Vattenbeskaffenheten.** Ytvattenprover har tagits vid fem tillfällen under våren-hösten 1960 (nämligen 11/4, 12/5, 7/6, 25/7 samt 15/9) dels inne i Ranviken och dels — som jämförelse — ute i Immeln utanför Boön.

Transparensmätningarna har skett med en vitskiva med 25 cm diameter.

Vattenfärg och järnhalt har bestämts kolorimetriskt i Aqua-Tester resp. Hellige-komparator, den specifika ledningsförmågan med en Cambridge conductivity bridge.

Mätningarna av vattnets reaktion har utförts elektrometriskt i fält med tillhjälp av en transportabel pH-meter.



Tab. 1. Resultaten av vattenanalyserna — The results of the water analyses

Lokal	pH	Spec. lednings- förm. $\mu\text{S}_{20}$	Cl <sup>-</sup>	Totalhårdhet	Fe
			mg/l	dH°	mg/l
Ranviken .....	6,4 (6,0—6,9)	69 (65—73)	10,4 (9,1—11,2)	0,8 (0,7—0,9)	0,5
Immeln utanför Boön ...	6,8 (6,6—7,1)	71 (68—73)	10,9 (10,3—11,5)	0,8 (0,7—0,9)	< 0,5

Lokal	KMnO <sub>4</sub> -förbrukn.		Vattenfärg	Sjöfärg	Transparens
	ofilt.	filt.	Pt		m
	mg/l		mg/l		
Ranviken .....	72 (56—98)	57 (27—85)	55 (30—100)	gulbrun- ljusbrun	> 1,7
Immeln utanför Boön ...	47 (44—51)	33 (29—40)	20 (15—25)	gul	5,8 (5,4—6,2)

Bestämningarna av totalhårdhet och kloridhalt har skett genom titrering med Clarks tvållösning resp. 0,05-n AgNO<sub>3</sub>-lösning.

KMnO<sub>4</sub>-förbrukningen har fastställts på såväl filtrerat som ofiltrerat prov genom titrering i sur miljö med 0,1-n KMnO<sub>4</sub>-lösning.

Analysresultaten är sammanställda i tab. 1, där dels medelvärden, dels extremvärden finns angivna.

Skillnader mellan de båda lokalerna föreligger i främsta rummet beträffande reaktion, vattenfärg, transparens, KMnO<sub>4</sub>-förbrukning och sjöfärg — egenskaper vilka i föreliggande fall är påverkade av halten av humusämnen i vattnet. Den inre Ranviken tillföres dels genom den tillrinnande bäcken, dels från omgivande kärrmarker mer eller mindre betydande mängd av sådana ämnen. De erhållna värdena på de båda lokalerna för ifrågakvarande egenskaper varierar i överensstämmelse härmed.

Ranvikens ställning i regionalt limnologiskt avseende framgår av tab. 2, i vilken några allmänt orienterande vattenegenskaper är upptagna. SV-Skåne får därvid representera ett utpräglat eutrofiområde. Aneboda-området i Småland ett utpräglat oligotrofiområde. Västervik-området har medtagits som exempel på ett svagt eutroft område.

Tab. 2. Sammanställning av värden för några karakteristiska egenskaper hos ytvattnet i sjöar inom olika områden i Sydsverige — *Comparison between the values of some characteristic properties of surface water in lakes within different regions in South Sweden*

Område	pH	Spec. ledningsförm. $\mu S_{20}$	Totalhårdh. $dH^{\circ}$	Cl- mg/l
Lund—Malmö—Ystad- området (ALMESTRAND 1951) ...	7,5—9,3	280	7,8	19
Västervik-området (THUNMARK 1945) .....	7,5	95	2,5	—
Aneboda-området (THUNMARK op.c.) .....	6,9	52	0,9	—
Ranviken .....	6,5	69	0,8	10,4

### Sjönötens ekologi

En del hithörande fakta är som tidigare påpekats redan kända, flera dock endast av allmän karaktär och osäkra som grundval för en utredande diskussion. Om trots detta ett försök skall göras att sammanfatta de olika miljöfaktorer som — bortsett från de klimatiska — synes vara av betydelse för sjönötens förekomst och utbredning, skulle i första hand nedanstående förtjäna att nämnas. Undersökningsresultaten från Ranviken får därvid, i den mån de meddela något nytt, komplettera framställningen.

1. Sjönöten förekommer rikligt mestadels endast i kalkfattiga eller måttligt kalkhaltiga vatten (GAMS 1927 s. 41 o.a.a., GLÜCK 1936 s. 327, APINIS 1940 s. 65). Kalkrikedomen tycks den i allmänhet inte kunna fördraga.<sup>2</sup> I detta sammanhang kan erinras om sjönötens relativt sparsamma tidigare förekomst inom lerslättområdena i Skåne, Västergötland och Östergötland (SAMUELSSON 1934 s. 100 samt FRIES 1951 kartan s. 168), ett förhållande som åtminstone delvis skulle kunna förklaras av den inom dessa områden rådande kalkrikedomen.

2. Vattnets reaktion tycks åtminstone under optimala förhållanden böra ligga omkring eller strax under pH 7. Starkt sura eller alkaliska vatten verka enligt APINIS (1940 s. 143) hämmande under olika stadier av groddutvecklingen och begränsa på så sätt sjönötens utbrednings-

<sup>2</sup> Hög kalkkoncentration verkar bl.a. hämmande på groddplantans utveckling (APINIS 1940 s. 143) och tycks även ogynnsamt påverka fruktbildningen (JANKOVIĆ 1953 s. 98).

möjligheter. Uppgiften grundar sig på experimentellt genomförda akvarieförsök.

3. Enligt flera källor utmärkes de vatten, där sjönöten förekommer, av en måttlig till hög halt av humusämnen (APINIS 1940 s. 65, GAMS 1925 s. 891, GLÜCK 1936 s. 327).

Undersökningsresultaten från Ranviken kan i hittills behandlade avseenden endast ytterligare stärka riktigheten av vad man tidigare känt till eller förmodat. Vikens vatten är kalkfattigt, har en måttlig humushalt samt svagt sur reaktion.

4. Sjönötens näringskrav är en annan fråga. Uppfattningarna av dess fordringar i detta avseende skiftar mellan eutrofi (GAMS 1927 s. 41 o.a.a.), MALMSTRÖM 1920 s. 52 o. 60) och mesotrofi (SAMUELSSON 1934 s. 101). Dock visar förekomsten i Ranviken, att den kunnat finna sin existens också i tämligen utpräglat oligotrofa miljöer. Här skulle också kunna framhållas sjönötens tidigare — av gjorda fynd att döma — mycket rikliga förekomst inom det småländska oligotrofområdet (jfr FRIES 1951 kartan s. 168). En förmodan skulle mot denna bakgrund kunna framföras, att sjönöten kanske riktigast borde betraktas som en med avseende på näringskrav tämligen eurytrof art med förmåga att förekomma i hela skalan av sjöar, från näringsrika till näringsfattiga, under förutsättning att övriga krav är tillgodosedda.

### Utvecklingshistorisk undersökning

Prov för makrofossilanalys av gyttjan har tagits på två ställen inom den sydvästligaste delen av viken, där sjönöten som framgått av det föregående har förekommit i historisk tid. Rekognoscerande borrhningar har företagits även inom övriga delar av viken. Frukter av sjönöten har vid dessa borrhningar endast påträffats inom i stort sett samma områden som vid de tidigare omnämnda bottenkrapningarna. Till dessa områden tycks sjönöten sålunda i huvudsak varit bunden under den tid den förekommit i viken. Makroprovtagningen har skett med en av författaren konstruerad borrhyp med stor provtagningskapacitet (DIGERFELDT 1966). Den använda modellen har en fri genomskärningsyta på 200 cm<sup>2</sup>. De uttagna proverna har vardera omfattat 5 cm av lagerföljden och deras volym har sålunda uppgått till 1000 cm<sup>3</sup>.

Mängden grovdetritus ingående i proverna har bestämts till såväl torrsvikt som volym (jfr SELLING 1938, WENNER 1940). Bestämningarna har utförts efter utsorteringen av makrofossilerna. (Angående användandet av termen grovdetritus för denna fraktion se diskussion i SELLING 1939

o. DIGERFELDT 1965). Före volymmätningen har materialet fått sedimentera 24 timmar i vattenfyllda glascylindrar.

I makrofossildiagrammet har frekvenserna som brukligt angivits med absoluta värden. Endast rikligare förekommande eller av annan anledning viktiga arter har medtagits.

BP 1. Borrpunkten är belägen 15 m från stranden, räknat från den innersta delen av viken. Den ligger centralt i flytbladsbältet, som här domineras av *Potamogeton natans* och *Nuphar luteum*. Den postglaciala gyttjans mäktighet uppgår till 3,2 m, därunder följer senglacial lergyttja. Vattendjup 1,2 m. Makroprovtagningen har omfattat avsnittet 15—143 cm av lagerföljden.

BP 2. Borrpunkten är belägen 35 m från stranden i utkanten av flytbladsbältet. Vegetationen domineras av *Potamogeton natans* och *Myriophyllum alterniflorum*. Den postglaciala gyttjans mäktighet uppgår till 4,6 m. Därunder följer senglacial lergyttja. Vattendjup 1,5 m. Makroprovtagningen har omfattat avsnittet 22,5—142,5 cm av lagerföljden.

**Pollendiagrammen.** Pollenanalysen har omfattat räkning i varje prov av 600—800 AP och därjämte förekommande NAP och sporer. Pollenfloristiskt tillhör diagrammen den nordöstliga varianten av Skåne-typen (NILSSON 1935 s. 508). De omspanner endast den senare delen av postglacial tid — det mest strandnära når ned till zon AT 1. Förekomsten av luckor i lagerserien och en delvis komprimerad lagerföljd har inom vissa avsnitt försvårat konnekteringen. Fullständigast utbildade är zoner SA 1 och SA 2 i diagrammet BP 2, zon SA 2 även i diagrammet BP 1.

Gemensamma och utmärkande drag är de högt liggande kurvorna för *Betula* och *Pinus*, som mer eller mindre fullständigt dominerar över övriga trädslag. Provtagningspunkternas läge i en grund vik medför, att en viss överrepresentation av *Pinus* åtminstone inom vissa avsnitt inte får uteslutas. Bäst utbildat är diagrammet BP 2, som omspanner zoner SB 1 till SA 2. Förekommande zongränser har förhållandevis lätt kunnat fastställas med ledning av i främsta rummet kurvorna för *Fagus* och *Carpinus*. Större svårigheter har det mera strandnära diagrammet BP 1 erbjudit. Som detta tolkats föreligger här ett avbrott i zonföljden, omspannande åtminstone hela zon SB 2. Den närmast äldre zon SB 1 är möjligen representerad genom ett enda prov.

**Makrofossildiagrammen.** Enligt principerna för tolkningen av kurvorna över mängden grovdetritus kan under den tid som profilerna omspanner en grundvattenperiod spåras i vartdera diagrammet. Gyttjan är i samband härmed såväl vid BP 1 som BP 2 utbildad som svämgyttja.

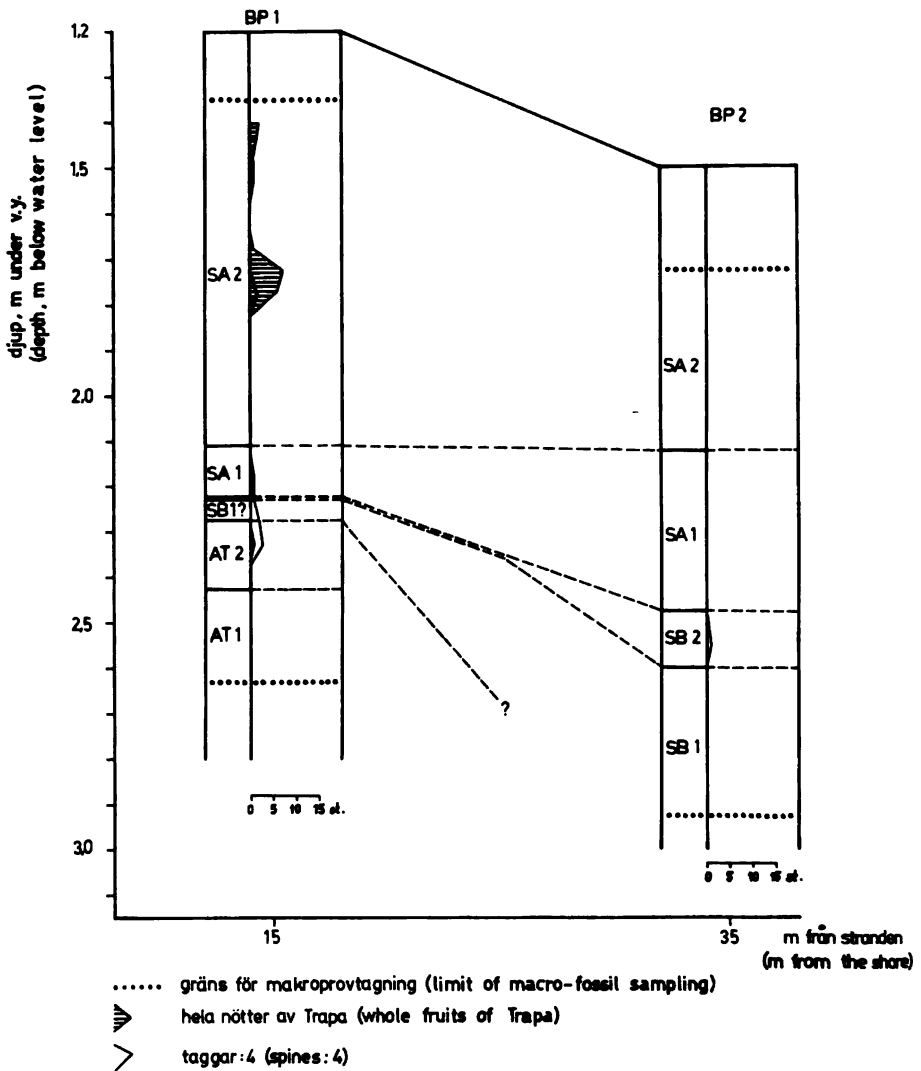
Ranviken Profilsammanställning

Fig. 4.

Grundvattenperioderna har som synes en ganska starkt avvikande tidsställning i de två diagrammen. Följande rekonstruktion av utvecklingen har ansetts möjlig (se äv. profilsammanställningen fig. 4).

Under äldre atlantisk tid är genom en ökning av grovdetritusmängden ett avtagande vattendjup registrerat vid BP 1. Under yngre atlantisk tid blir detta förhållande än mera markerat. Inget kan här sägas om vad som orsakat minskningen av vattendjupet — en sänkning av vattenståndet eller en fortskridande uppgrundning. Det avbrott i sedimentationen, orsakat av att bottnen kommit upp ovan sedimentationsgränsen, som därefter inträffar, omspanner åtminstone hela yngre subboreal tid. Föregående äldre subboreal tid är möjligen representerad genom ett enda prov. Omkring motsvarande nivå i lagerserien kulminerar också mängden i gyttjan ingående grovdetritus.

Vid den djupare belägna BP 2 gör sig en minskning av vattendjupet gällande först under äldre subboreal tid. Mängden grovdetritus ökar tämligen snabbt och når sitt maximum omkring övergången mellan äldre och yngre subboreal tid.

Frågan om hur sambandet mellan de registrerade grundvattenperioderna i de två profilerna skall tolkas får tills vidare lämnas öppen. Sambandet kan vara direkt, varvid den oliktidiga registreringen endast skulle vara en följd av skillnaden i vattendjup mellan provtagningspunkterna. Denna skillnad har, som framgår av profilsammanställningen fig. 4, under det skede som här är aktuellt varit mer framträdande än i nutid. Direkt samband kan också saknas. Svar på frågan kan inte ges förrän den mellanliggande utvecklingen klarlagts, antingen genom ytterligare borrhningar mellan BP 1 och BP 2 eller inom andra områden av viken.

Genom åter möjliggjord avsättning av gyttja gör sig en efterföljande höjning av vattenståndet gällande vid BP 2 under yngre subboreal tid, vid BP 1 först senare under äldre subatlantisk tid. Vattenståndshöjningen kan med säkerhet sättas i samband med den begynnande klimatförsämringen, som sedan fortskridit fram under subatlantisk tid. Överst i lagerföljden tyder kurvorna för mängden grovdetritus, vid BP 1 även uppträdandet av olika vattenväxter, på ett återigen något avtagande vattendjup. Frågan om orsaken till förändringen får tills vidare lämnas öppen.

Beträffande bestämningarna av grovdetritusmängden är den principiella överensstämmelsen mellan volym- och torrviktkurvorna nära nog fullständig (jfr SELLING 1940). Volymkurvans relativt blygsamma uppgång i samband med de markerade torrviktkmaxima inom lagren med svämgyttja kräver kanske dock en förklaring. Den efter utsorteringen av förekommande makrofossil kvarvarande fraktionen har i dessa prover till största delen utgjorts av små bark- och vedfragment,

d.v.s. strandnära sedimenterat driftmaterial, som då det i samband med volymbestämmningen fick sedimentera, mycket effektivt packades samman. Detta till skillnad från övriga prover, vilkas slammingsåterstod till övervägande del utgjordes av mer eller mindre långtrådigt material. Mätningarna kom härigenom huvudsakligen att omfatta det bottenfällda materialet egen volym och endast en förhållandevis ringa mängd mellanlagrande vatten. Detta förhållande kan åtminstone delvis förklara de låga värden, som erhållits vid volymbestämmningarna. Den möjligheten kan givetvis inte heller uteslutas, att en absolut höjning av grovdetrituskomponentens spec. vikt i de ifrågavarande proverna och en rikligare förekomst av utsvämmat minerogent material bidragit till den avvikande kurvgången.

### Sjönöten i Ranviken

Som nämndes i inledningen motiverades undersökningen av Ranviken till en del av de upplysningar, som skulle kunna erhållas beträffande sjönötens uppträdande under allra yngsta postglacial tid, innefattande även historisk tid. Den förhoppningen fanns också att här, vid nordgränsen för artens utbredning, ett liknande samspel mellan mindre klimatiska förändringar och förekomst av sjönöten skulle kunna påvisas, som tidigare FRÖMAN (1936, 1944) och WENNER (1940; jfr kritik av SELLING 1940) anser sig ha funnit inom andra områden. På grundval enbart av de här beskrivna rekognoscerande profilerna är något sådant dock inte möjligt. Rent allmänt gäller, att största svårigheten i ett sådant påvisande ligger i, att med säkerhet kunna skilja klimatiskt betingade variationer i förekomsten av sjönöten från variationer, som orsakats av förändrade rent lokala förhållanden (vattendjup, strömningsförhållanden, exposition etc.).

De fruktfragment, som vid BP 1 och BP 2 påträffats inom svämgyttjan och närmast angränsande lager, utgör med säkerhet driftmaterial och visar endast att sjönöten under motsvarande tid förekommit i viken.<sup>3</sup>

Förekomsten vid BP 1 under yngre atlantisk tid markerar däremot en lokal växtplats. Nära till hands ligger att antaga, att sjönötens tidsmässiga uppträdande här har bestämts av den tidigare omnämnda höjningen av vattenståndet på så sätt, att invandringen ägt rum då vattendjupet blivit för arten lämpligt. Kulminationen är kortvarig.

<sup>3</sup> MALMSTRÖM (1920 s. 66) dröjer något vid tanken att sjönöten i Ranviken inte skulle ha förekommit naturligt utan ha blivit i sen tid inplanterad. Han finner dock denna möjlighet mindre trolig — ett antagande som alltså visat sig vara riktigt.

Det har ofta framhållits, att sjönöten's slutliga försvinnande från Ranviken får skyllas på människans ingrepp. Delvis är det säkerligen så. Åren efter upptäckten började något som väl närmast bör kunna liknas vid rovjakt på vikens bestånd av sjönöt. Mera sällan har man i ett naturvetenskapligt arbete anledning att referera till ett rent skönlitterärt verk, men en målande beskrivning av denna rovjakt har HARRY MARTINSSON givit i »Nässlorna blomma» (11:e uppl. 1949, A. Bonniers förl., s. 12), där han skriver: »Vad beträffar den lilla ångaren på tvåmilasjön så levde den om somrarna huvudsakligen på att frakta botanikbitna turister till en viss vik. Detta gjorde att det ymniga men sista vilda beståndet av sjönöt som Sveriges land hade med tiden försvann, vart bortrövat och utrotat. Sjönöten blomman i Elmen [=Immeln], dog ut för poängers skull».

Endast så mycket får väl dock skyllas på människan, att hon påskyndade sjönöten's försvinnande. Ranviken har under den tid det gäller utgjort en långt mot norr framskjuten förekomst, varifrån sjönöten förr eller senare — senast i samband med vikens igenväxning som en följd av den fortskridande uppgrundningen — varit dömd att försvinna.

### Summary

#### Notes on the Development and Limnology of Ranviken Bay in Lake Immeln

For some years the author has been occupied with an investigation of the Post-glacial development of Ranviken Bay in Lake Immeln in NE Scania. The Bay is best known as the last natural habitat in Sweden of *Trapa natans* L. In this paper a description is given of two reconnaissance borings made at the beginning of this investigation. The paper also gives the result of a limnological investigation which the author carried out as a small contribution to the knowledge of the ecology of *Trapa*.

#### General description

The shape of the Bay and the depth conditions can be seen in the map, Fig. 1. The inner part of Ranviken Bay is well sheltered by high and wooded moraine hills. In the southern part the shore is very steep and bouldery, the rest having a more gradual slope usually consisting of marshy ground.

#### Limnological investigation

*Trapa* died out in Ranviken Bay in 1913 (MALMSTRÖM 1915). It is certain that since then no appreciable change has occurred in the environmental conditions of the Bay, except for a somewhat wider extension of the shore and lake vegetation due to the continuous filling-up. The limnological investi-



gation consisted of analyses of some important chemical and physical water properties and mapping of the macrophyte vegetation.

The location of Ranviken Bay within a region dominated by oligotrophic archæan moraine has left its mark on the vegetation. The number of species found is small (see p. 220 f.). However, the helophyte as well as the nymphæid vegetation is quantitatively well developed, owing to the small water depth and the occurrence of organogenic mud as substratum even in shallow water near the shore. The distribution of the vegetation is shown in the map, Fig. 3.

The results of the water analyses are shown in Table 1. Water samples were taken in the inner Ranviken Bay as well as in the open lake (off the island of Boön) on five occasions from April to September 1960. The medium and extreme values are given in the table.

The position of Ranviken Bay from a regio-limnological point of view is given in Table 2 which includes some elucidatory water properties. In this connection the Lund—Malmö—Ystad area represents a region of eutrophy, the Aneboda area a region of oligotrophy and the Västervik area a slightly eutrophic region.

### *The ecology of Trapa*

Present knowledge on the ecology of *Trapa* is partly based on information of a rather general nature. If, in spite of this, an attempt should be made to summarize the different environmental conditions which — apart from the climate — seem to be of importance for the existence of *Trapa*, the following facts may be mentioned in the first place.

1. *Trapa* usually occurs in large quantities only in lakes poor in lime or with a moderate lime percentage (GAMS 1927, p. 41, GLÜCK 1936, p. 327, APINIS 1940, p. 65). It does not seem to be able to tolerate richness in lime (APINIS 1940, p. 143, JANKOVIĆ 1953, p. 98).

2. It appears that the water reaction, at least under optimal conditions, ought to be around or just below pH 7. According to APINIS (1940, p. 143) highly acid or alkaline water has an unfavourable effect in the different phases of development of the plant.

3. According to many sources, the lakes in which *Trapa* occurs are characterized by a moderate to high proportion of humus (Apinis 1940, p. 65, GAMS 1925, p. 891, GLÜCK 1936, p. 327).

From the aspects hitherto dealt with, the result of the limnological investigation of Ranviken Bay can only further confirm the correctness of the information already given. The water in the Bay is poor in lime, contains a moderate proportion of humus and has a slightly acid reaction.

4. Concerning the trophic requirements of *Trapa*, opinions vary from eutrophy (GAMS 1927, p. 41, MALMSTRÖM 1920, p. 52 and 60) to mesotrophy (SAMUELSSON 1934, p. 101). However, the occurrence of *Trapa* in Ranviken Bay shows that the species has been able to subsist also in rather oligotrophic habitats. In this connection the previously very rich occurrence of *Trapa* within the oligotrophic region of Småland (FRIES 1951, the map on p. 168) should be mentioned. Against this background it may be suggested that, on account of its trophic requirements *Trapa* should perhaps most correctly be

regarded as a rather eurytrophic species with the ability to subsist within the whole scale from eutrophic to oligotrophic lakes, provided that other environmental requirements are given.

### *Investigation of the development*

The investigation is based on macro-fossil and one pollen analysis. The two profiles described are situated in the south-western part of the Bay (Fig. 1). In boring, a new type of sampler designed by the author (DIGERFELDT 1966) was used. The free area of intersection of the model used amounts to 200 cm<sup>2</sup>. Each sample comprised 5 cm of the sequence; the volume thus amounted to 1000 cm<sup>3</sup>.

The quantity of coarse detritus in the samples was determined in the same way as in similar earlier investigations by SELLING (1938, 1940) and WENNER (1939). The determination of quantity included both volume and dry weight. The volume was determined after the material had settled for 24 hours in water-filled bottles.

The pollen analysis is based on the counting in each sample of 600—800 AP and of NAP and spores occurring amongst these. Pollenfloristically, the diagrams belong to the north-eastern variant of the Scanian type (NILSSON 1935, p. 508). The occurrence of interruptions in the zone succession and a partly compressed sediment sequence complicated the correlation in certain parts of the diagrams.

According to the principles for the interpretation of the curves of the quantity of coarse detritus, one shallow water period can be traced in each diagram. Nothing can as yet be said about the cause for the decrease in water depth during these periods. It may be due to a direct lowering of the water level, but it may also be caused by the normal development of the Bay, with a gradually reduced water depth on account of the sedimentation and filling-up, without having any connection with changes in the water level. The question of the connection between the two shallow water periods registered must also be left open for the present (see also Fig. 4). The connection can be direct, whereby the difference in time between their registration is only a consequence of the difference in water depth at the boring points. There may also be no direct connection. An answer to this question cannot be given until intervening development has been elucidated by additional borings between BP 1 and BP 2 or in other parts of the Bay. A rise in the water level is registered at BP 2 in the Late Sub-boreal period, at BP 1 not before the Early Sub-atlantic period. This rise can certainly be connected with the Late Post-glacial climate deterioration.

### *Trapa in Ranviken Bay*

The fruit fragments which occur in the mud both at BP 1 and BP 2 in connection with the shallow water period certainly derive from fruits which were transported by the drift and deposited near the shore. The occurrence at BP 1 during the Late Sub-atlantic period, on the other hand, certainly indicates a local habitat.

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Dyop under v.v. Depth below water level		Logarithm
Profounder	Number of sample	
15	342	[Patterned Area]
	343	
	344	
	345	
	346	
	347	
	348	
	349	
	350	
	351	
20	352	[Patterned Area]
	353	
	354	
	355	
	356	
	357	
	358	
	359	
	360	
	361	
25	362	[Patterned Area]
	363	
	364	
	365	
	366	
	367	

**BP 2**

1.5		
	368	
	369	
	370	
	371	
	372	
2.0	373	
	374	
	375	
	376	
	377	
	378	
	379	
	380	
	381	
	382	
2.5	383	
	384	
	385	
	386	
	387	
	388	
	389	
	390	
	391	
	392	



## Some Species of *Pseudogynoxys* from Ecuador

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Descriptions of a large number of *Senecio* species from South America have been published. Many of these however are certainly very closely related and it is difficult and sometimes impossible to determine the differences between them by means of the descriptions provided. It is necessary to see correctly determined specimens for exact determination, and such are generally not available. It is impossible to know the genetic variation in a species and the influence of the local conditions on the plants without having sufficient material of the taxa. As to climbing species it is difficult to find out the habit of a species because of the great variability in different parts of the plant. For this case the leaves especially are very variable. Certainly the descriptions of many plants are more descriptions of specimens than of species, but nevertheless the descriptions are necessary for gaining an opinion of the real character of a species.

As recently as 1950 the subgenus *Pseudogynoxys* of *Senecio* was separated from *Senecio* by CABRERA to form an independent genus and seems to be quite as variable and critical as *Senecio* itself. In the collections from Ecuador in the Regnellian herbarium, Museum of Natural History in Stockholm, there are several plants, which, evidently not belonging to the species of *Senecio*, have been transferred to *Pseudogynoxys* and appear to be hitherto undescribed. The genus seems to be rather richly represented in Ecuador.

### *Pseudogynoxys Asplundii* K. Afzelius n. sp.

Scandens. Rami herbacei, virides, striati, fistulosi, adulti glabri, juvenes pubescentes. Folia alterna, petiolata. Petioli 0,5—1,5 cm longi, basi dilatati, sulcati, sparse pubescentes, margines sulci dense pubescentes. Laminae membranaceae, ovatae, acutae, basi rotundatae seu subcordatae, margine sparse denticulatae,



Fig. 1. *Pseudogynoxys Asplundii* K. Afzelius. Holotype.

supra glabrae, subtus sparse pubescentes. Folia ramorum adultorum usque ad 8 cm longa, 5 cm lata, folia ramorum capituliferorum minora, usque ad 5 cm longa, 3 cm lata. Inflorescentiae in ramis  $\pm$  longis collectae. Pedunculi pubescentes, usque ad 2 cm longi, 1—5 capitula gerentes. Bracteae lineares seu lineari-oblancoolatae usque ad 5 mm longae. Pedicelli usque ad 1,5 cm longi, pubescentes. Capitula radiata, campanulata. Bracteolae calyculi circiter 8, lineares, 4—5 mm longae. Bracteae involucri 12—14, 8 mm longae, basi 1 mm latae, apice ciliatae, glabrae seu sparse pubescentes. Flores radii 5—6. Tubulus 5—5,5 mm longus, ligula 6 mm longa, 2—2,5 mm lata. Flores disci usque ad 10 mm longi, tubulus 7 mm, limbus 3 mm longus. Achenia immatura pubescentia. Pappus albus.

Stem climbing, almost entirely herbaceous, striate, green with yellowish ridges. The main stems glabrous, the flowering branches sparsely pubescent. Blades with generally four pairs of curved lateral veins, visible on both sides and most salient on the lower surface. (Fig. 1.)

**Ecuador**, prov. Guayas, Dos Mangas near Manglaralto, cleared forest, 2.V.1956 leg. ERIK ASPLUND n:o 20395. Type in Herb. Regnell., Bot. Department, Nat. Hist. Museum, Stockholm.

*Pseudogynoxys chiribogensis* K. Afzelius n. sp.

Scandens. Rami fulvo-striati, puberuli, glabrescentes,  $\pm$  fistulosi. Folia alterna (internodia 3—8 cm longa), petiolata, membranacea. Petioli usque ad 2 cm longi, sulcati, parce puberuli, in marginibus sulci dense pubescentes. Laminae in partibus junioribus floriferis ovatae, basi obtusae, apice acuminatae, margine dentatae, supra glabrae, subtus parce puberuli, usque ad 8 cm longi, 4 cm lati, in ramis adultis basi subcordatae seu truncatae, apice longe acuminatae, usque ad 12 cm longae, 7 cm latae. Capitula radiata, pauca in apice ramorum, longe pedunculata, pedunculi usque ad 7 cm longi, pubescentes ut basis capitulorum. Bracteolae calyculi circiter 20 lineares, pubescentes, circiter 5 mm longae. Bracteae involucri 25—30, 10—11 mm longae, acuminatae, glabrae seu parvisimae pubescentes, apice ciliatae,  $\pm$  rubescentes. Flores radii circiter 20, tubuli 8 mm longi, ligulae 15 mm longae, 4 mm latae. Flores disci 12—16 mm longi. Achenia immatura pubescentia. Pappus albus, 9—10 mm longus.

Stem climbing, striate, green with yellowish ridges, scarcely puberulent, soon glabrate. Leaves alternate, petiolate. Petioles up to 1,5 cm long, furrowed, sparsely pubescent, with dense pubescence at the edges of the furrow. Blade lanceolate-ovate to ovate with rounded to truncate or slightly cordate base, acuminate or cuspidate apex and serrate margin, glabrous on the upper surface, very sparsely hairy on the under side. Heads radiate, few in the top of the stem on long slightly pubescent peduncles, broadly campanulate. Bracteoles of the calycle linear, pubescent as the base of the head. Bracts of the involucre linear-lanceolate,



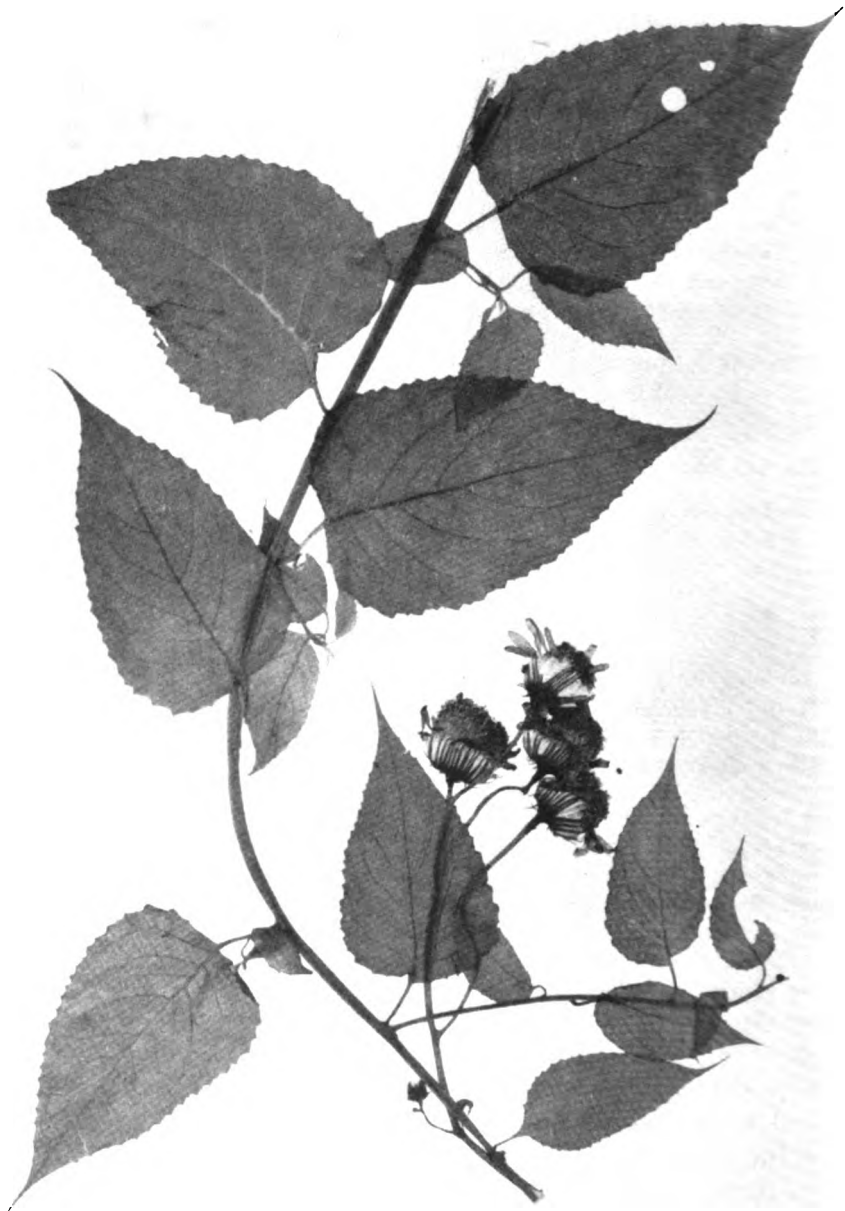


Fig. 2. *Pseudogynoxys chiribogensis* K. Afzelius.

**Fig. 2. *Pseudogynoxys chiribogensis* K. Afzelius. — Holotype.**

acuminate, with ciliate, often reddish apex. The pressed capitula 10—12 mm in diam. at the base, 20 mm at the top of the involucre. Flowers dark orange red. (Fig. 2.)

**Ecuador**, prov. Pichincha, Chiriboga, thicket on river-bank, alt. 1900 m, 5.V.1955 leg. ERIK ASPLUND n:o 16221. Type in Herb. Regnell., Bot. Department, Nat. Hist. Museum, Stockholm.

*Pseudogynoxys chongonensis* K. Afzelius n. sp.

Scandens. Rami striati, fistulosi, juventute parce puberuli, postea glabrati. Folia alterna, petiolata. Petiolus c. 15 mm longus, sulcatus, pubescens, margines sulci densior pubescentes. Lamina chartacea, sicca canoviridis, ovata, basi cordata, saepe  $\pm$  inaequilatera, apice acuta seu obtusa, margine distanter et minute denticulata, subinvoluta, supra minutissime puberula, subtus parce puberula, usque ad 7 cm longa, 5 cm lata. Capitula radiata, in ramis brevibus, pubescentibus cum foliis valde reductis collecta. Pedicelli flexuosi, c. 1 cm longi, pubescentes. Involucre campanulatum, basi pubescens. Bracteolae calyculi c. 10, 4—5 mm longae, lineares, acutae, parce puberuli. Bracteae involucri 13—18, saepe 15, lineari-lanceolatae, glabrae, apice ciliatae, 9 mm longae, basi 0,7—1,5 mm latae. Flores radii 7—9. Tubulus 4—5 mm longus, ligula 6 mm longa, 2—2,5 mm lata, elliptica. Flores disci 9—12 mm longi, tubulus 7—9 mm longus, limbus c. 3 mm longus. Achenia immatura pubescentia. Pappus albus, 9—10 mm longus.

Climbing shrub, stems striate with tawny ridges. Petioles with dilated, firm base. Blades greyish green with very scarce and minute pubescence above, pubescent especially on the veins beneath. The heads on short branches, sometimes on longer branches with normal leaves or on quite thin twigs, resembling peduncles. (Fig. 3.)

**Ecuador**, prov. Guayas, E of Chongon, 23.IX.1952 leg. F. FAGERLIND et G. WIBOM n:o 268. Typus in Herb. Regnell., Bot. Department, Nat. Hist. Museum, Stockholm.

*Pseudogynoxys guarumalensis* K. Afzelius n. sp.

Scandens. Rami fulvo-striati (herbacei?) fistulosi, juvenes puberuli, mox glabrescentes. Folia alterna (internodia 2—4 cm longa), petiolata, membranacea. Petioli 1—3 cm longi, sulcati, sparse, in marginibus sulci densissime pubescentes. Laminae ovatae seu lanceolato-ovatae, basi cordatae, apice acuminatae, margine dentatae, supra nervis majoribus exceptis glabra, subtus sparse, in nervibus et in margine densior pubescentes, usque ad 9 cm longae et 6 cm latae. Folia superiora minora, basi truncata seu obtusa. Capitula radiata, magna, in apice ramorum pauca, longe pedunculata, basi puberula. Pedunculi 4—8 cm, striati, puberuli, apice incrassati. Bracteolae calyculi circiter 20, lanceolatae, 7—11 (—14) mm longae, basi 2 mm latae, parce pubescentes. Bracteae involucri circiter 30, lanceolatae, glabrae, apice acuminatae, ciliatae, 13—14 mm longae, basi 2—2,5 mm latae. Flores radii circiter 20, tubulus 8 mm longus, ligula 15—16 mm longa, 5 mm lata. Flores disci c. 14 mm longi. Pappus albus, 10 mm longus. Achenia immatura pubescentia.

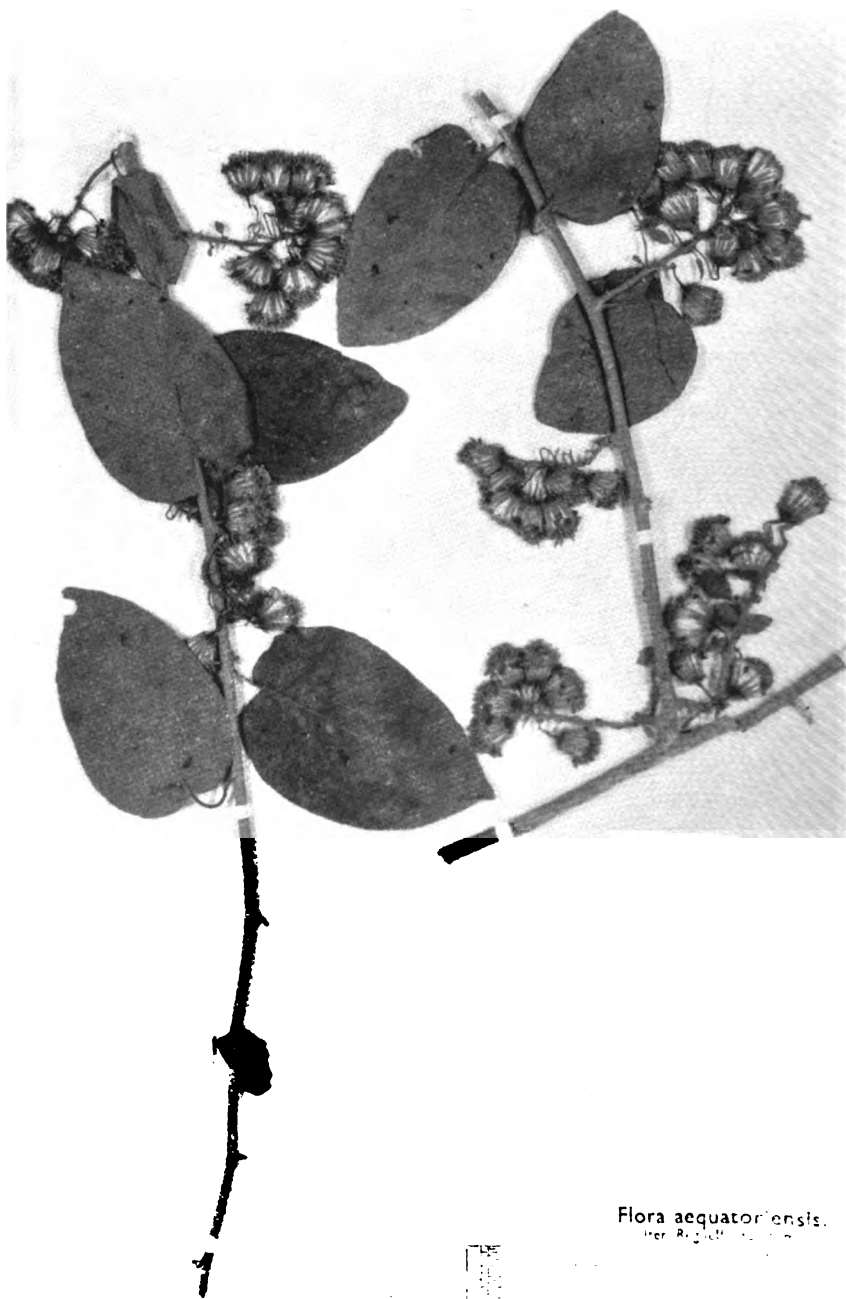


Fig. 3. *Pseudogynoxys chongonensis* K. Afzelius. — Holotype.

Stem climbing, striate, green with yellowish ridges, as young scarcely pubescent, later on glabrous. Leaves alternate, petiolate. Petioles 1—3 cm long, sulcate, sparsely hairy and with dense hair borders at the edges of the groove. Blades ovate, acute with cordate or truncate base and serrate margins, glabrous above, underneath hairy on the nerves and on the margins. Heads radiate, few at the top of the branches on  $\pm$  long thinly hairy peduncles, incrassated under the heads, and with pubescent base. The pressed heads about 1,5 cm broad at the base, up to 3,5 cm at the broadest parts. Flowers orange red, stigmas of disc flowers orange yellow. (Fig. 4.)

Ecuador, prov. Pichincha, Guarumal (between San Juan and Chiriboga), climbing in very wet thicket, alt. c. 2100 m, 2.VIII.1955 leg. ERIC ASPLUND n:o 17140. Type in Herb. Regnell., Bot. Department, Nat. Hist. Museum, Stockholm.

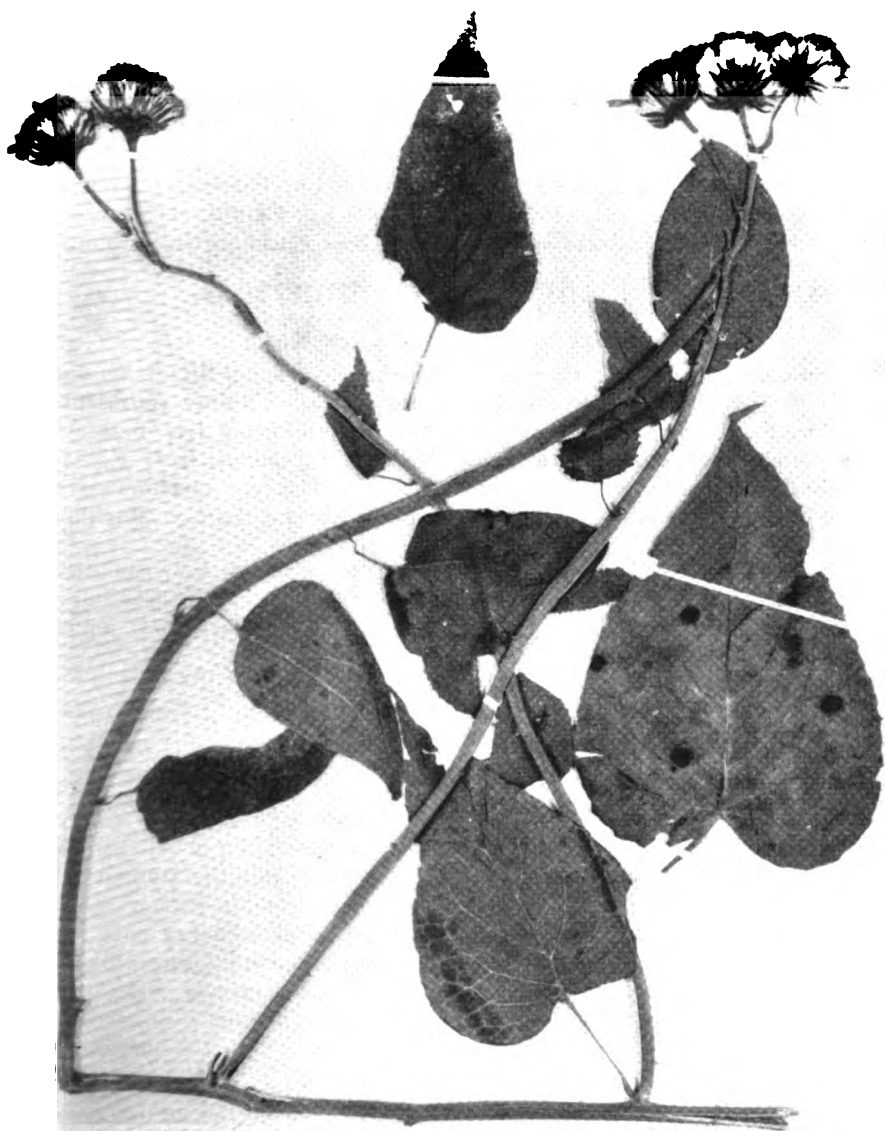
*Pseudogynoxys pastazensis* K. Afzelius n. sp.

Scandens. Rami fulvo-striati, subglabri, fistulosi. Folia alterna (internodia 5—7 cm longa), petiolata, membranacea. Petioli sulcati, 3—4 cm longi, basi incrassati, glabri. Laminae ovatae, basi cordatae seu rotundatae, apice longe acuminatae, margine sparse denticulatae,  $\pm$  involutae, supra glabrae, subtus glabrae vel praecipue in nervibus rarissime pilosae, usque ad 13,5 cm longae, 9,5 cm latae. Folia ramorum capituliferorum minora. Petioli c. 1,5 cm longi, laminae ovato-lanceolatae longe acuminatae, basi truncatae seu rotundatae, margine dentatae, usque ad 6,5 cm longae, 3 cm latae. Capitula magna, radiata, pauca in apice ramorum longorum. Bracteolae calyculi 12—15, 7—8 mm longae, basi 1,5 mm latae. Bracteeae involucri 25—30, 11—12 mm longae, basi 1,5—2,5 mm latae, longe acuminatae, apice ciliatae. Flores radii 12—15, tubulus circiter 8 mm longus, ligula 15 mm longa et 4—5 mm lata. Flores disci 11—17 mm longi, dentes 2,5 mm longi, lineari-lanceolati. Achenia costata, puberula. Pappus albus, 10 mm longus.

Climbing. Stem striate with yellowish ridges, nearly glabrous. Leaves alternate, petiolate. Petiole up to 4 cm long with incrassated base, furrowed, glabrous or with slight pubescence on the edges of the furrow. Blade ovate to broadly ovate, acuminate with cordate or rounded base, glabrous above and with scattered hairs beneath. The nerves very prominent beneath. The leaves of the flowering branches small, ovate-lanceolate with truncate base and serrate margin. Heads radiate, few at the top of  $\pm$  long branches, pressed up to 2 cm broad, at the very base 1 cm. Flowers dark orange red. (Fig. 5.)

Probably from the same Rio Verde as *P. viridifluminis* Cuatr., coll. PACHANO 235 and apparently closely related to this species, but differs





Her. Regnell, quartus.  
Flora aequatoriensis

Prov. Tungurahua, valle of Rio Pastaza, Hacienda Rio Verde, 1900.

Erik Asplund.

**Fig. 5. *Pseudognoxys pastuzensis* K. Afzelius. — Holotype.**

according to the description of CUATRECASAS in Fedde Rep. Spec. Nov. 55 (1953) p. 152 by having larger and broader leaves with longer petioles, more and larger bracts of calyculus and involucrum and somewhat larger capitula and flowers.

**Ecuador**, prov. **Tungurahua**, valley of Rio Pastaza, Hacienda Rio Verde Grande, thicket, alt. 1500 m, 26.VII.1939 leg. ERIK ASPLUND n:o 7838. Type in Herb. Regnell., Bot. Department, Nat. Hist. Museum, Stockholm.

### Summary

The genus *Pseudogynoxys* (*Compositae*), formerly a subgenus of *Senecio* but nowadays treated as an independent genus, is rather richly represented in Ecuador. From this country are described the following five new species: *P. Asplundii* K. Afz., *P. chiribogensis* K. Afz., *P. chongonensis* K. Afz., *P. guarumalensis* K. Afz., and *P. pastazensis* K. Afz. The type specimens are preserved in the Regnellian herbarium, Museum of Natural History, Stockholm.

## A New Species of *Corydalis* sect. *Oocapnos* from Afghanistan

(Studies in the flora of Afghanistan 4.)

By PER WENDELBO

Botanical Garden, Gothenburg

### Abstract

*Corydalis metallica*, a fourth species of sect. *Oocapnos* M. Pop., is described from N.E. Afghanistan. It is most closely related to *C. fedtschenkoana* Regel. A key to the section *Oocapnos* is presented.

*Corydalis metallica* sp. nov. (Fig. 2 a—d, 3, 4).

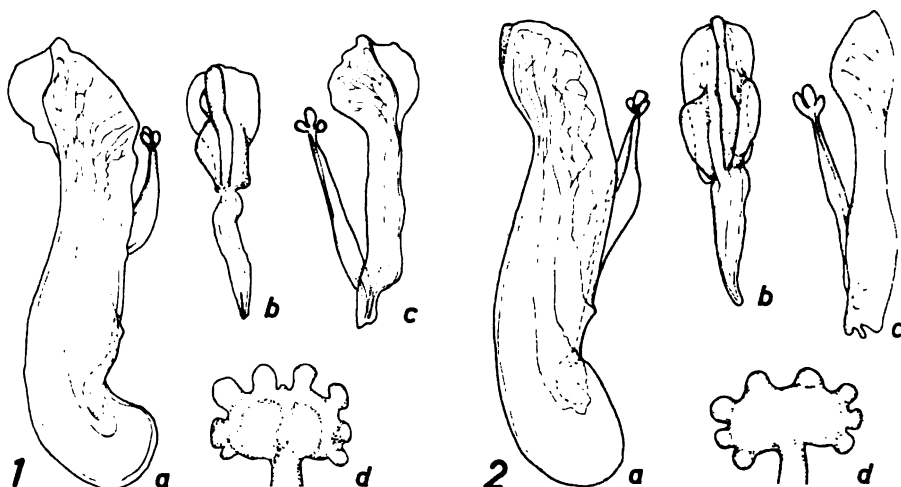
Arcte affinis *C. fedtschenkoanae* Regel a qua differt foliorum lamina ovata usque late ovata multo magis dissecta et petalis exterioribus non cristatis.

Foliorum lamina usque ad 16 cm longa et 9 cm lata, ovata usque late ovata, bi- usque tripinnata, foliolis partitis usque bipartitis, segmentis ultimae ordinis elliptico-ovatis mucronatis, crassa metallice canescenti-coerulescens segmentis apice purpureo coloratis. Sepala 4—5 mm longa. Corolla alba petalis exterioribus violaceo-carinatis, petalis interioribus apice violaceo-marginatis; petalum superius usque ad 22 mm longum calcare crasso obtuso tertiam partem petali longitudinis occupante incluso; petalum inferius usque ad 15 mm longum; petala interiora usque ad 13 mm longa. Capsula valde inflata.

**Afghanistan.** Parvan: Panjshir valley; west side of Anjuman pass, limestone scree, 3900 m, 22 July 1962, HEDGE & WENDELBO 5428 holotype BG, isotype E; Panjshir valley; Darrah Rastagal, scree, 4100 m, 17 July 1962, HEDGE & WENDELBO 5192 BG, E. — Badakhshan: Noshah-Gebiet (westl. Wakhan), Schiefer-Schutthang ohne Feinerde, 4200 m, Juli 1964, ROEMER 194 M

The inflated capsule and the thick metallic-blue leaves, as well as the white violet-spotted corolla with a short thick spur, make *C. metallica* a member of the section *Oocapnos* M. Pop. It is most closely related to *C. fedtschenkoana* Regel (fig. 5), but is distinguished by the ovate to broadly ovate (not oblong) outline of the leaf lamina which is also





Figs. 1—2: 1. *Corydalis fedtschenkoana* Regel (leg. KRASSNOV LE). 2. *C. metallica* sp. nov. (HEDGE & WENDELBO 5428 BG). a. Upper outer petal,  $\times 3$ ; b. Lateral inner petal,  $\times 3$ ; c. Lower outer petal  $\times 3$ ; d. Stigma,  $\times 15$ .

much more finely dissected. The outer petals are non-cristate and also more narrowly winged (figs. 1—2).

*C. metallica* is a high alpine species which grows on scree. H. & W. 5428 was found on limestone scree as scattered specimens together with a few other typical scree plants like *Oxygraphis shaftoana* Aitch. et Hemsl., *Euphorbia aucheri* Boiss., *Wakilia afghanica* Gilli and *Androsace villosa* L.

With this novelty included, the section *Oocarpnos* consists of four species: *C. fedtschenkoana* Regel (Tian Shan and Pamir-Alai), *C. metallica* Wendelbo (N.E. Hindukush), *C. crassissima* Camb. (Karakoram, N.W. Himalaya, N.E. Hindukush) and *C. crassifolia* Royle s.str. (Kumaun Himalaya).

Provisional key to the species of *Corydalis* sect. *Oocarpnos*:

1. Leaf lamina nearly orbicular in outline, 3-lobed or 3-partite with lobulate segments. Corolla 23 mm or more long ..... *C. crassissima* Camb.
- + Leaf lamina oblong to broadly ovate, pinnate ..... 2
2. Lamina of leaves pinnate with partite segments. Corolla c. 17 mm long ..... *C. crassifolia* Royle s.str.
- + Lamina of leaves bi- or tripinnate with partite to bi-partite leaflets. Corolla c. 20 mm long ..... 3
3. Outline of leaf lamina ovate to broadly ovate. Outer petals not cristate ..... *C. metallica* Wendelbo
- + Outline of leaf lamina oblong. Outer petals cristate *C. fedtschenkoana* Regel

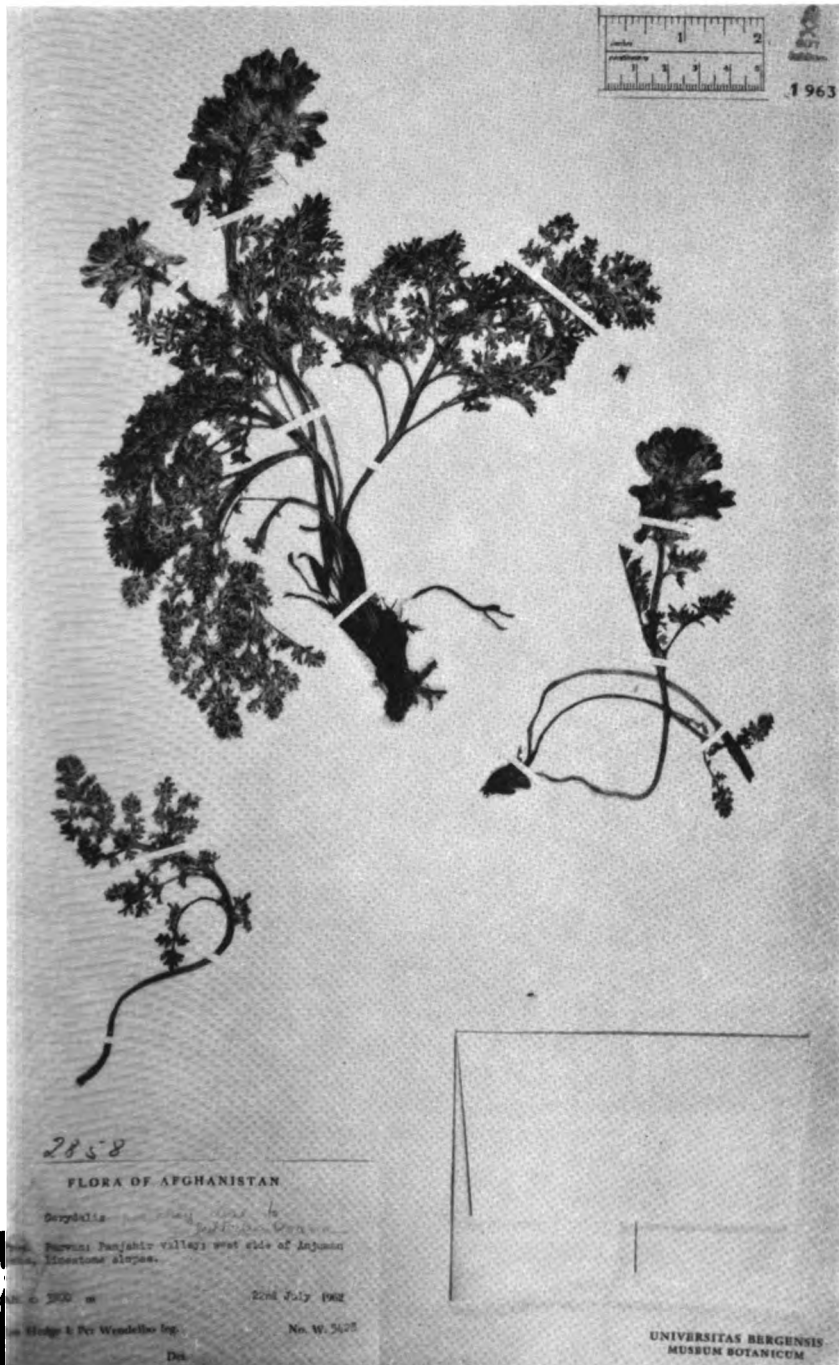


Fig. 3. Type sheet of *Corydalis metallica* sp. nov. (HEDGE & WENDELBO 5428 Herb. BG).





Fig. 5. *Corydalis fedtschenkoana* Regel (Flora Iliensis leg. KRASSNOV 1886 Herb. LE).

HOOKE (1872, 127) placed *C. crassissima* Camb. (1844, tab. 11) and *C. physocarpa* Camb. (1844, tab. 12) as synonyms of *C. crassifolia* Royle (1839, p. 68). But there can be no doubt that two species are involved. Unfortunately the name *C. crassifolia* s.str. (with *C. physocarpa* as a synonym) has to be used for the geographically more restricted and probably rather rare, eastern representative of the complex. The common and well known Kashmir plant illustrated as *C. crassifolia* (COVENTRY 1927, tab. 15; BLATTER 1928, pl. 9 fig. 4; FEDDE 1936, fig. 72) and often referred to in literature under that name (e.g. WENDELBO 1952, p. 31) is in fact *C. crassissima*. I hope to come back to this in another paper when more material has been studied and a map of the distribution of the two species can be presented.

FEDDE (1936, p. 137) made a new genus *Cysticorydalis* with *C. crassifolia* (Royle) Fedde as the type species, and *C. fedtschenkoana* (Regel) Fedde — of which he had seen no material — as the only other species. POPOV (1937, p. 698), without knowing FEDDE's treatment, granted the same two species a section of their own, *Oocapnos* within *Corydalis*, but later (1963, p. 49) he stated that FEDDE probably was right in treating them as belonging to a separate genus. After having studied material of the four species that now constitute the group, I have come to the conclusion that it is better to follow the first view of POPOV. Apart from the inflated capsule there does not seem to be any other character to separate *Cysticorydalis* from *Corydalis*.

### Acknowledgements

I am indebted to the Directors of the following herbaria for loan of material: Komarov Botanical Institute, Leningrad; British Museum, London; Botanische Staatssammlung, München; Naturhistoriska Riksmuseet, Stockholm.

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## Några nya eller mindre väl kända hieracier från norra Sverige

Av STEN NORDENSTAM

Näsbypark

I början av augusti 1965 exkurrerade jag i Pite lappmark under något mer än en vecka i sällskap med fil. dr. GUNNAR WISTRAND, Falun och fil. lic. JIM LUNDQVIST, Uppsala, vilka båda under de senaste åren sänt mig en stor mängd hieracier för bestämning från detta område. Vår avsikt var i första hand att studera hieraciefloran i Arjeplogs sockens barrskogsregion, men tillfälligt kommo vi även över gränsen mot Arvidsjaur. Vid två tillfällen kommo vi upp mot barrskogsregionens övre gräns, nämligen vid Laisälven ovan Adolfström och i fjällbjörkskogen på sydöstra sidan av fjället Barturte, som ligger sydväst om sjön Tjeggelvas.

På örtrika lokaler i barrskogsregionen med *Geranium silvaticum*, *Aconitum septentrionale* m.fl., ofta på fuktiga och översilade marker utefter bäckar, uppträder i allmänhet en rik hieracieflora. Huvudsakligen utgöres denna av arter tillhörande *Silvaticiformia*, men inom hela Arjeplogs socken träffas på samma slags marker ej sällsynt arter tillhörande *Nigrescentia* och emellanåt även arter tillhörande *Alpina genuina*. Ännu inom den till sitt omfång mycket obetydliga del av Arvidsjauras socken som besöktes, fanns två arter *Nigrescentia*. Liknande förhållanden har jag iakttagit inom sydöstra delen av Sorsele socken, ett område som också gränsar mot Arjeplog. Förekomsten av *Alpina* i skogslandets hieracieflora var sålunda ej ägnad att väcka min förvåning. Däremot blev jag överraskad av att finna att åtskilliga arter tillhörande gruppen *Alpestria*, även kallad *Prenanthoidea*, traditionsenligt uppdelad i undergrupperna *Semidovrensia*, *Dovrensia* och *Prenanthea*, förekom inte blott på den enda men extremt rika hieracielokal som besöktes i *regio subalpina*, nämligen Barturtefjällets sydöst-

sluttning, där arter tillhörande alla tre undergrupperna anträffades, utan även på några lokaler i barrskoglandet. En lokal belägen öster om byn Svannäs intill gränsen mot Arvidsjaur, hyste sålunda flera arter tillhörande denna grupp. Några *Alpestria*, tillhörande undergruppen *Prenanthea*, hade vid vårt besök i området icke börjat blomma, och ännu vid mitten av månaden, då JIM LUNDQVIST ånyo besökte ett par lokaler för dylika arter voro de flesta allt för outvecklade för att insamlade exemplar skulle kunna utredas.

I det följande nybeskrivas en *Alpina* och två *Dovrencia*, alla från Pite lappmark, varjämte två *Silvaticiformia*, *H. lyratifolium* Norrl. och *H. phaeocybe* Norrl., behandlas. Den förra känner jag från Torne, Pite och Lycksele lappmarker. Den senare har jag anträffat i Norrbotten. Den är icke tidigare känd från Sverige.

#### Förkortningar:

F.=TH. FOLIN. — J.=K. JOHANSSON. — L.=JIM LUNDQVIST. — EN.=ERNST NORDSTRÖM. — GS.=GUNNAR SAMUELSSON. — W.=GUNNAR WISTRAND. — R.=Riksmuseets herbarium. — !=Insamlad eller sedd av mig.

### Alpina

#### *Hieracium catobleutum* n. sp. (fig. 1)

*Caulis* 30—50 cm altus calathidiis 2—3 fere aequalibus, laete viridis basi pallidus, pilis longis dense vestitus, supra medio parcius pilosus sed densius floccosus, sub involucrio centimetris summis exceptis dense floccosus, pilis atroviridis 1—1,5 mm longis apice canescentis glandulisque parvis et microglandulis obtectus, vulgo 1-foliat. — *Folia* araneosa, supra laete viridia, subtus pallidiora, basalia 6—10, exteriora rotundata vel ovalia, intermedia et intima elliptica, minutissime denticulata dentibus porrigentibus, basis in petiolum longissimum sensim transiens, folium caulinum ambis marginis dentibus 2—3 parvis, anguste ellipticum—lanceolatum, omnia supra et in marginibus pilosa, folia basalia microglandulis singulis, folium caulinum in mergine microglandulis dense obtectum. — *Anthela* indeterminata, acladium 5—70 mm longum, saltem ramus supremus ceteris longe transiens (raro deorsum vertens). — *Involucra* ca 12 mm longa, 8 mm lata, basi rotundata, atroviridia, substellata, pilis basi nigris apice canescentis sat longe pilosa, glandulis microglandulisque sparse—mediocriter dense detecta, involucrium supremum ceteris parum major. — *Squamae* exteriores triangulares, atrovirides non marginatae, intermediae angustae, in apicem subito contractum sensim angustatae, glabra vel minute comatae, interiores pallide viridimarginatae—omnino viridia pilis lineam simplicem formantes, glandulis singulis et microglandulis raris stellatae, subcomatae. — *Calathidium* mediocre, radians, ligulae ca 2 mm latae substylosae, dentes ligularum glabri—subciliati. — *Stylus* siccus fuscescens.



Fig. 1. *Hieracium catobleutum* n.sp. Arjeplog, väster om Adolfsström vid Laisälven  
6.8.1965 L., W. och I (R.).



**Pite lappmark:** Arjeplogs socken, väster om Adolfsström vid Laisälven ovan forsarna på alluvialplatå N om älven i gles björkskog 6.8.1965. L., W. och ! (R., holotypus).

Genom sina långskaftade blad med tvärt avsatt bladskiva och flerholkiga stjälk erinrar denna art mycket om *Nigrescentia*. Till bladform, färg och allmän habitus är den rätt lik en uppförstorad *H. petiolatum* Elfstr. Akladiet varierar i längd men är ofta kort. Då det är som kortast är den översta grenen påfallande långt överskjutande, ofta kandelaberformigt böjd, och den påfallande stora biholken kan då ibland på denna gren genom sin tyngd bli nedåtriktad.

Den ljust gröna färgen och de ljusa stjälk- och bladskiftsbaserna ger arten ett säreget utseende. Holkarnas karaktäristiska lyster påminner något om den som förekommer hos *H. megalodon* Dahlst., en art tillhörande en helt annan grupp. De täta mikroglandlerna i stjälkbladets kanter hänvisa arten tydligt till gruppen *Alpina*, inom vilken den närmar sig *H. spodiozum* Om. var. *juobbanse* Om. (ny lokal för denna art är Norge: Helgeland, Krutvassröddingen 11.8. 1957. leg. BERTIL NORDENSTAM) och ännu mera *H. profusum* Om. (1929).

### Silvaticiformia

*H. lyratifolium* Norrl. (1906) c. diagn. in lingua fenn.; *H. apicesignatum* Folin (1931) c. diagn. Mycket närstående, möjligen blott en smalbladsform är *H. subfucatum* (Zahn) 1923; *H. fucatum* K. Joh. (1908) non Zahn (1906). — Fig. 2.

Denna art som jag redan 1927 insamlade på några lokaler i Lycksele socken och som jag då sände exemplar av till K. JOHANSSON och till TH. FOLIN, anträffade jag åter år 1961 i Finland nära byn Kalkkimaa i Alatornio socken, där jag botaniserade i sällskap med fil. mag. ARTURO RAILONSALA, Torneå. År 1962 anträffade jag den flerstädes i samma socken några mil norr om Torneå stad, ävenledes i sällskap med RAILONSALA, på och nedom berget Palovaara. I Helsingfors botaniska museum har jag sett exemplar av arten från åtskilliga lokaler i norra och mellersta Finland insamlade av auctor, A. PALMGREN m.fl.

Från Sverige har jag sett exemplar av arten i herbarier eller själv insamlat den från nedanstående lokaler:

### Torne lappmark:

Luossavare 31.7.1904. J. s.nom. *H. fucatum* K. Joh. (R.)

Snuoratjåkko, björkskog 19.8. 1916. GS. s. nom. *H. fucatum* K. Joh. (R.)

Pesisvare 26.7. 1925. EN. s. nom. *H. fucatum* K. Joh. (R.)



Fig. 2. *Hieracium lyratifolium* Norrl. Lycksele, Metseken, nära Bjurfors 7.7.1931! (R.).

**Pite lappmark:**

Ringsele—Vitträsk 21.7. 1929. F. (R.)

Ballasviken 4.8. 1929. F. (R.)

Rebaken 1929. F. (R.)

Rebaksudden 14.8. 1929. F. (R.)

**Lycksele lappmark:** Lycksele socken,Spänningträskliden 27. 7. 1927! »*H. reversidens* K. Joh. n. sp. ad int.» det. K. Joh.; *H. apicesignatum* Folin, det. F. 1931.

Kittelforsheden 1927 !

Bjurbäcksländet, nära Storskrabbmyren 11.8. 1931 ! (R.)

Bjurbäcksländet, N om Sörträsket 1931 !

Metseken, nära Bjurfors 7.7. 1931 ! (R.) — Fig. 2.

Bäcknäs 1959 !

Den mycket närstående *H. subfucatum* Zahn är insamlad av K. JOHANSSON åren 1905—06 vid Kiruna, där även ERNST NORDSTRÖM samlat den år 1925 (R.). Av K. JOHANSSON vid Björkliden vid Torne träsk samlade exemplar (R.) vill jag också sammanföra med denna form, som skiljer sig från *lyratifolium* genom sina trubbtandade smala blad med största bredden något under eller vid mitten, sina något grövre holkar med trubbigare fjäll etc. Se härom FOLIN 1931 sid. 8. Den av FOLIN (1942) beskrivna *H. basicanescens*, som jag förgäves sökt återfinna på Prinskullen vid Kvikkjokk, synes mig vara en specifik art (jmf. FOLIN sid. 6—7 i anf. arbete).

***H. phaeocybe* Norrl.**

Denna art samlades av mig den 15.7. 1962 i Norrbotten: Neder-torneå socken, Militärbarackområdet vid Myllyjärvi. Den är ny för Sverige. Arten tillhör en grupp mycket kritiska arter, *H. caesitium* Norrl., *H. christianense* Dt. m.fl. I JULIN & NORDENSTAM (1964) medtogs den inte, emedan jag då icke lyckats få tillgång till autentiskt jämförelsematerial, men sedan dylikt på hösten 1965 genom förmedling av professor TYCHO NORLINDH utlånats från Helsingfors botaniska museum till Riksmuseet i Stockholm, har formen kunnat bestämmas. Den förekom vid Myllyjärvi tillsammans med *H. caesiiflorum* Almqu. på ett inskränkt område i omedelbara närheten av en militärbarack.

I Finland är arten blott känd från norra Österbotten, där jag också i sällskap med RAILONSALA en gång samlat den, nära byn Kalkkimaa i Alatornio socken 17.7. 1961.



Fig. 3. *Hieracium barturtense* n.sp. Arjeplog, Barturtevalle 9.8.1965 L., W. och ! (R.).

**Dovrensia*****Hieracium barturtense* n. sp. (fig. 3)**

**Caulis** 25—60 cm altus, gracilis, inferne fuscus, mediocres—longe, supra medium brevius pilosus et glandulis unicis, superne pilis longitudine variis et glandulis sat dense vestitus, ubique stellatus, 3—5-folius. — **Folia** viridia,  $\pm$  fusco-maculata, subtus pallide viridia, sat longe et dense, in nervo dorsali subdense pilosa, supra glabra, superiora  $\pm$  stellata,  $\pm$  lanceolata subobtusata, basin versus sensim angustata, in petiolo anguste alati subamplexicauli longe decurrentia; intermedia et superiora  $\pm$  late lanceolata sessilia basi subamplexientia, omnia dentis parum parvis patentibus denticulata. — **Inflorescentia** inaequaliter paniculata, rami pilis in apice pallidulis brevibus molli-bus et glandulis unicis vestiti, stellati; acladium vulgo 3—4 cm longum, pedicellis sat brevibus cano-tomentosum, pilis brevibus et glandulis minutis parcissime obsitum. — **Involutura** atroviridia floccis cano-tomentosa, ca 10 mm longa basi  $\pm$  rotundata, pilis in apice longius—brevius canescentibus et glandulis minutis obsita. — **Squamae** atroviridia obtusae, apice breve comatae, exteriores  $\pm$  triangulares marginibus laxae sed sat dense, in dorsa parcius floccosae, interiores glabrae vel in marginibus parcissime stellatae, in apice lacerato breve comatae. — **Calathium** subparvum, radians. — **Ligulae** 2—2,5 mm latae, apice brevissime ciliatae. — **Styli** lutei, sicci inconspicue obscuriores.

**Pite lapp mark:** Arjeplogs socken, Barturtevalle, sydsluttningen—sydöst-sluttningen nedom rasbranten i fjällbjörkskogen och även längre ned i övre delen av reg. silvatica på flera ställen, 620—640 m ö.h. 9.8. 1965. L., W. och! (R., holotypus).

Bland förut kända *Dovrensia* med fläckiga blad märkas *H. protractum* Fr. och *H. miarellum* Om. Den här beskrivna mycket särpräglade arten röjer ingen närmare släktskap med någondera av dessa arter. I synnerhet den sistnämnda är mycket olik *H. barturtense*. Den har nämligen utbildad bladrosett, övervägande glandelhåriga holkar m.m. Holkarna hos *H. barturtense* påminna genom sin hårbeklädnad och sitt rikliga stjärnludd mycket om *H. vulgatum* (Fr.) Almqu.

***H. praecanuliforme* n. sp. (fig. 4)**

**Caulis** 30—80 cm altus, inferne fuscescens, dense longe pilosus et sat stellatus, superne densius stellatus pilis sat raris et glandulis singulis obtectus, 3—6-folius. — **Folia**  $\pm$  fuscomaculata, basalia fere emarcida elliptica—late lanceolata subobtusata longe petiolata, caulina brevius petiolata—sessilia, integra—paucidentata, basin versus dilatata semiamplexientia, superiora angusta—reducta, omnia supra glabra marginibus sat dense ciliata, subtus pilosa—subglabra, in nervo dorsali dense pilosa. — **Anthela** lata composita indeterminata, ramis longis tenuis floccis subcanis, pilis glandulisque solitariis adspersis, apicibus ad summum 2—4-cephalis, acladia 5—30 mm. — **Involutura** mediocra—angusta, ca 10 mm longa, 7 mm lata, basi rotundata.



Fig. 4. *Hieracium praecanuliforme* n.sp. Arjeplog, 7 km Ö om Svannäs 29.7.1965  
W. (R.).

canotomentosa. — Squamae exteriores latiusculae obtusae, pilis in apice canis sat longis et glandulis longis—brevis singulis obtectae, praecipue in marginibus dense sed laxe stellatae, interiores sat glabrae, late laete-marginatae. — Calathidia majuscula, aureolutea. — Ligulae 1,5—2 mm latae, apice glabrae—leviter ciliatae. — Stylus luteus, siccus fuscescens.

Pite lappmark: Arjeplogs socken, 7 km E om Svannäs, örtrik skog nära sockengränsen 29.7. 1965 W. 5.8. 1965. L., W. och ! (R., holotypus). — Arvidsjaur's socken: samma lokal strax Ö om föreg. L., W. o. !

Genom sina av stjärnludd brokiga holkar påminner denna art om *H. praecanulum* Om. (1912), som emellertid saknar bladfläckar och har spetsigare, enbart glandelhåriga holkfjäll, ej som hos denna övervägande enkelhår. Genom sina fläckiga blad och brokiga holkar påminner den också något om *H. percnophyllum* Dt., som emellertid genom sina nästan hjärtlika övre blad och sin mångbladiga stjälk visar att den tillhör en helt annan formgrupp inom *Dovrencia*.

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## Vad är *Hieracium auricula* $\beta$ *majus* Wahlenberg?

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I den nyligen utkomna Flora upsaliensis (ALMQUIST 1965 p. 252) berördes i förbigående detta spörsmål, som erbjuder ett visst, även icke-hieraciologiskt intresse. Då floran ej kunde belastas med nödig utredning, vill jag här dryfta saken litet mer ingående.

Formen i fråga var ett av de få nya taxa, som uppställdes i WAHLENBERGS Flora upsaliensis (1820). Diagnosen är helt kort och berör blott ett par detaljer i artdiagnosen:

*Hieracium Auricula*: scapo subunifolio paucifloro, — — —  
 $\beta$  *majus*: scapo subumbellato unifolio.

Han har tydligen avsett en form med utbildat stjälkblad och talrikare blomkorgar. En så beskaffad modifikation kan ju tänkas ha stått modell, men med hänsyn till WG:s — i synnerhet beträffande hieracier — kollektiva artuppfattning måste man misstänka något annat. Detta bestyrkes av den följande framställningen (se nedan p. 261).

Först bör emellertid inskjutas, att HARTMAN (1820) samtidigt med WG uppställde *H. Auricula*  $\beta$  *major*, varmed i huvudsak avsågs den sedermera som *H. suecicum* Fr. beskrivna arten. Att WG:s nya form kunde vara densamma, förmodade redan HARTMAN (1832). Benämningen kom att skifta i olika upplagor av H:s flora, där man finner:

i ed. 2 (1832): *H. dubium* L., syn. *H. Auricula*  $\beta$  *major* Hartm. och trol. Wg.  
i ed. 3 (1838): *H. Auricula*  $\beta$  *major* (utan syn.) } [Namnet *H. dubium* L. här  
i ed. 4 (1843): *H. Auricula*  $\beta$  *major* (utan syn.) } överfört på *H. pratense*.]  
i ed. 5 (1849): *H. Auricula*  $\beta$  *majus*, delvis identisk med *H. suecicum* Fr.  
i ed. 6 (1854): *H. Auricula* \**suecicum* Fr.

I fortsättningen (ed. 7—9) höllos *H. auricula* och *H. suecicum* artskilda, och den förras  $\beta$  *majus* blev en »medelform», som (enl. be-



skrivn.) tycks ha omfattat även *H. cochleatum* Norrl. — I ed. 10 (1870) kallas den  $\beta$  *majus* Wg.

Den wahlenbergiska formen försvann som synes för en tid ur synonymiken. När *H. suecicum* uppställdes (FRIES 1848), sades den dock höra dit, och detta fastslogs emfatiskt, sedan FRIES — väl först efter WG:s död (1851) — fått granska dennes herbarium. Nu skrevs (FRIES 1862 p. 20): »*H. suecicum* Fr.<sup>1</sup> — — — syn. *H. Auricula majus* Wahlenb. ex ore, loco, herbar.» Detta lakoniska domslut, karakteristiskt för FRIES, väcker ändock starka tvivel. Lokalen för WG:s växt ligger ute på lerslätten (jfr nedan), den uppräknas ej bland F:s övriga, ingenting bestyrker att F. själv besökt platsen, ej heller har någon annan där tagit *H. suecicum*, och beläggmaterialet kräver en speciell kommentar, som nu följer.

Ur herb. WG härrör (i Uppsala bot. museum) ett ark med bevarad orig.-etikett (skriven av WG): »*Hieracium Auricula major*. Upsala, på trädessäkrar öster om staden, der *Salvia* — — — /radslutet bortklippt, datum på ny rad:/ d. 18 Juni 1819». — På arket finnas 1): en basalbit och en blomstjälk av *H. pratense* ssp. *colliniforme* i sent knoppstadium, 2): ett storväxt men typiskt ex. av *H. auricula* i blom, samt 3): tydliga spår av en tredje, som överflyttats till eget ark med (ofullständig) avskrift av WG:s etikett; detta individ (i fruktstadium) är en stolonlös, knappast bestämbar *glomeratum*-f.(?). Enligt påsatta bestämningslappar (det. DAHLST. 1906) skulle 1) och 2) vara *H. floribundum* \**suecicum*, 3) däremot *H. pratense* \**colliniforme* (med en tillfogad krumelur, som kan vara ett ?). Lapparna skrevos ej av D. själv, vilken — om namnen verkligen motsvara hans bestämmningar — tycks ha haft usel belysning och mycket bråttom. (Opålitlighet i några liknande fall har förut anmärkts (ALMQU. 1965 p. 251, Bot. Not. 1962 p. 102).) Förväxling av lappar är mera trolig.

Detta oskickligt hopkomna sammelsurium kan ju betvivlas ha något alls att skaffa med WG:s ursprungliga kollekt. Möjligt vore, att FRIES, som i WG:s växt ville se *H. suecicum*, kan ha ditlagt jämförelsematerial, men intet ex. är den. Det enda oomtvistligt äkta är etiketten. Just emedan denna bevarats, vill man dock tro, att något ex. hör ihop med den. I så fall icke 3), som tagits vid annan tidpunkt. Ej heller 2), ty detta individ saknar stjälkblad (tvärt emot WG:s diagnos). Som sannolikt autentisk återstår då blott *colliniforme*, vars nära förestående blom-

<sup>1</sup> Denna säges på grund av ändrad beskrivning vara en annan än *H. suecicum* Fr. 1848 (jfr DAHLST. 1890 p. 51, not 3). Som likväl den uppländska *suecicum* ingår i båda, har oklarheten ingen betydelse för vårt spörsmål.

ning också motsvarar datum. Detta ex. är i varje fall nu det enda, som kan antagas vara typ för *H. auricula*  $\beta$  *majus*. Äktheten bestyrkes i viss mån genom artbeskrivningen, där följande kan läsas.

WG berör (1820) efter diagnosen på *H. auricula* först artens tidigt blommande, småväxta normaltyp med blott vid basen cilierade blad osv., varefter följer (i översättning): »förekommer efter midsommar mera storväxt med utlöpare merendels stjälbärande, blad överallt cilierade, stjälkar mer än fotshöga, ovan mitten 2—3-flikade, grenar nästan i flock». Illa stämmer detta med *auricula*, föga med *suecicum*, bättre med *colliniforme* (grenigheten dock ovanlig); stjälbärande »utlöpare» (=flageller) äro hos den sistnämnda ofta förhanden. — I Flora svecica (1826), där  $\beta$  *majus* fick än kortare diagnos (blott »scapo subumbellato»), mildrades ett par av de nämnda uttrycken och tillades dels »foliis — — — vix glaucescentibus», dels »scapis — — — multifloris», vilket yttermera pekar mot *pratense*-gruppen.

Samma rang som  $\beta$  *majus* fick också vår sydsvenska *pratense*-ras (*H. auricula*  $\gamma$  *collinum*: WG 1826 p. 492). Denna kände WG blott genom FRIES' beskrivning och ett från F. bekommet, frodigt herb.-ex., vars nära samhörighet med  $\beta$  förbisågs. Att båda ställdes under *H. auricula*, förklaras av bladens glabrescens dvs. brist på stjärnhår. Habitueellt likna de vida mer gruppen *Cymosina* (= *H. dubium* Wg), där stjärnhårigheten är karakteriserande.

Inga lokaler angåvos för  $\beta$  *majus*, ej heller sades antydda kännetecken uttryckligen gälla denna, vilket ju dock måste vara meningen. Vad som föresvävat WG kan delvis också ha varit större,  $\pm$  auriculoida former av annat slag (vissa *Suecica* m.fl.), som han knappast kan ha undgått under sina resor. Ingen dylik synes dock ha blivit samlad eller studerad. I varje fall kan  $\beta$  *majus* i Fl. svec. kallas både diffus och kollektiv, liksom WG:s flesta hieracier. Vill man fixera namnet till en bestämd form, kommer givetvis den upsaliensiska ensam i fråga. Och då har man ingenting att välja på, utom *colliniforme* och möjligen *suecicum*. Om denna setts av WG i Uppsalatrakten<sup>2</sup> är dock lika tvivelaktigt som att han skulle taxonomiskt ha skilt den från *H. auricula*.

*H. suecicum* kan anses eliminerad redan av den på WG:s etikett utpekade växtplatsen.<sup>3</sup> Arten växer inte på uppländska backar och ler-

<sup>2</sup> Det torde i så fall ha varit i Jumkil, som han första(?) gången besökt 1819. Närmare staden är *H. suecicum* högst ovanlig.

<sup>3</sup> Denna låg inom nuvar. Renhållningsverkets område vid foten av 'Boländernas' bergknallar. Platsen hyste som sagt också *Salvia pratensis*, »vid en lada» (enl. kollekt

gården och var nog då som nu husvill på slätten. Desto mer finner nu *colliniforme* trivsel där.

Allt som allt synes mig knappast minsta tvivel råda, att *H. auricula*  $\beta$  *majus* Wg (1820) är identisk med *H. colliniforme* (N.&P.), vilken i så fall tagits vid Uppsala redan 1819. — Fyndet nämnes (med lätt reservation) i den nya Fl. ups. och ställer därmed artens historia hos oss i ny dager. Frånsett den ss. inhemsk i Götaland betraktade populationen, har *H. pratense* (coll.) vanligen ansetts vara en utkomling från Lunds och Uppsalas botaniska trädgårdar, så hos DAHLSTEDT (1890 osv.) och ännu i LINDMANS flora (1918, 1926), här dock med tillägg av »Norrköping, Växjö». Dessa subsponsanta *pratense*-former identifierades av D. med ssp. *colliniforme* N.&P. [Synonymiken må lämnas åsido, tidvis har t.ex. namnet *H. collinum* Gochn. nyttjats för *pratense*.] — *H. colliniforme*, som den kallas i nämnda flora, omfattar en tydligen mycket vital formgrupp (olika kloner), i flera svenska landskap nu tillfinnandes utan samband med botaniska trädgårdar. Av allt att döma har den också spritts med vallfrö och utsäde. En och annan  $\pm$  mörkstiftig inkomling bör kanske räknas till *H. pratense* s.str. Artgränsen synes vara föga skarp, och jag talar nedan blott om *H. pratense* (coll.).

*H. pratense* påträffades, frånsett WG:s fynd, först 1845 vid Uppsala (utanför botaniska trädgården) och efterhand flerstädes i grannskapet. Under 1900-talet har den befunnits vida spridd. Det finns också diverse gamla men sällan bestyrkta uppgifter. Beläggex. (det. DAHLST.) föreligga från Blidö i Roslagen (1862), och sådana måste väl ha setts av FRIES (1849), då han godtog uppgifter från Gävle (först hos HARTM. 1838) och »Mälaren» dvs. Hilleshög (LINDBERG i Bot. Not. 1845 p. 207).<sup>4</sup> Denne tillade Göteborg (hos HARTM. 1879). De spridda fynden skvallra om införsel på skilda vägar och tider, vadan ett sådant 1819 ej alls förefaller osannolikt. Som förvildad vid Lund antyddes växten först av FRIES (1828 p. 251).

av WG samma dag som han tog ängsfibblan). Där fanns även *Melampyrum arvense* WG m.fl.). Sällskapet har en viss betydelse för härkomsten (se p. 263).

<sup>4</sup> Själv har LINDBERG (1882 p. 9) förnekat riktigheten av detta fynd, skyllande på namnförbistringen. Han hade dock 1845 kallat växten *H. collinum* Fr. (då = *H. pratense*). FRIES ändrade namnet först 1848! Dessutom finns ett beläggex. i herb. Th.M.Fries (det Dahlst.), enl. etiketten taget av L. vid Hilleshög 1847, då han åter besökte mälardäarna. Påpekas bör kanske dock, att unge FRIES då var 15 år gammal, och etiketten (med artnamnet *H. pratense*) är skriven av honom troligen först på 1850-talet (av stilen att döma).

WG:s fynd stödes även av att *Salvia pratensis* och *Melampyrum arvense* växte bredvid *Hieracium pratense*. En sådan trio kan ju misstänkas ha gemensam proveniens (utsäde?). Den inkom i så fall senast på 1770-talet, då EHRHART upptäckte salvian. För insamling av denna raritet besöktes platsen ibland under 1800-talet, men ängsfibblan (bekantgjord först 1965!) blev säkert aldrig eftersökt. Den kan givetvis ha varit mindre långlivad än de andra, som levde kvar till vår tid. Å andra sidan är hög ålder tänkbar, ty platsen ligger vid den äldsta Stockholmsvägen (på 1700-talet redan deklasserad). Lika möjligt är, att *H. pratense* haft obemärkta förekomster i grannskapet. Största delen av slätten var nämligen terra incognita för äldre botanistgenerationer. Man gick eller for vägarna fram, högst sällan görande nämnvärda avstickare (frånsett Kungsängen m.fl. linneanska stråk). Och hur många brydde sig om hieracier?

Kuriöst nog satte WG (1820) *H. dubium* Ehrh. som synonym till *H. auricula*  $\beta$  *majus*. Enda grunden torde ha varit, att E. nämner salvian och alltså besökt platsen. Att redan han sett ängsfibblan och med sin skarpblick reagerat för den, låter ju tänka sig. Faktiskt säges hans kollekt ha varit *H. dubium* L., men ej alldeles typisk (MEYER 1836 p. 417). Denna utsaga vore — om riktig — tämligen sensationell. Den är dock motsagd av FRIES (1862 p. 34) och möjligen förut i någon tysk publikation. MEYERS hieraciologiska kompetens är ej obestridd. Hans uppgift styrkte dock HARTMAN att godtaga namnet *H. dubium* L. för *H. pratense* (se ovan p. 259).

Det linneanska artnamnet öppnar ännu ett perspektiv bakåt. Om *H. pratense* fanns på WG:s tid, kan den ju som sagt vara äldre än så. Det är därför ej alldeles uteslutet, att redan LINNÉ råkat på en flyktig förekomst av arten. Detta gäve god förklaring till hans diagnos på *H. dubium* (»foliis ovato-oblongis» osv.). Hela diagnosen m.m. motsvarar bättre *H. pratense* än varje annan piloselloid i trakten. Som lokal uppgavs Vaksala (ett par km från den wahlenbergiska fyndplatsen), men växten återfanns aldrig. Identiteten av *H. dubium* L. är en mycket omskriven men troligen olöslig fråga. Mest sannolikt är nog, att han haft för ögonen en bredbladig *Cymosina*-form. Jag har därför t.ex. i Fl. ups. behållit namnet i wahlenbergiskt kollektiv bemärkelse (= *Cymosina*-gruppen).

## Zusammenfassung

Verf. zeigt, dass *Hieracium auricula*  $\beta$  *majus* Wg in Fl. ups. (1820) mit allergrösster Wahrscheinlichkeit *H. [pratense ssp.] colliniforme* N. & P. entspricht. Das Belegmaterial (mit Etikette von Wg selbst geschrieben) enthält nebst ein Ex. von *colliniforme* leider auch ein Paar andere Formen, welche jedoch die Diagnose WAHLENBERGS gänzlich widersprechen und als irrtümliche Beimischungen zu deuten sind. — E. FRIES' Identifizierung von WAHLENBERGS  $\beta$  *majus* mit *H. suecicum* Fr. ist aus mehreren Gründen kaum stichhaltig.

Der Fund WAHLENBERGS (im Jahre 1819) ist der älteste der betreffenden Pflanze in Schweden. Sie wuchs mit *Salvia pratensis* und *Melampyrum arvense* zusammen und dürfte wie diese mit fremder Aussaat importiert gewesen sein. Nunmehr ist *H. colliniforme* in Süd- und Mittelschweden ziemlich verbreitet.

## Litteratur

Emedan denna uppsats väsentligen är en kommentar till min framställning av *Hieracium* i Fl. ups., kan beträffande citaten hänvisas till dess litteraturförteckning. Den behöver här endast kompletteras med följande:

ALMQUIST, E. 1965: Flora upsaliensis.<sup>5</sup> — Uppsala.

LINDBERG, C. J. 1882: Hieraciologiska bidrag. — I: Göteb. högre allm. lärov:s årsprogram. Göteborg.

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<sup>5</sup> En oriktighet i denna må samtidigt rättas. Där står (p. 252 t.h. upptill): Mant.III (1845), skall vara Mant.II(1839).

## Studies in *Montia* L. and *Claytonia* L. and Allied Genera

### I. Two New Genera, *Mona* and *Paxia*

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**Abstract:** Two new genera, *Mona* Ö. Nilss. and *Paxia* Ö. Nilss., of the subfam. *Montioideae* of *Portulacaceae* are described, the former from northern South America, the latter from Australia and New Zealand. Both are monotypic. They are compared in detail with *Montia* and *Claytonia*, see tab. 1. Particular attention has been paid to the pollen morphology. Both genera have characteristic pollen grains well distinguished from others found in the subfam. In the Australian species the chromosome number was determined,  $2n=96$ .

Within the genera *Montia* L. and *Claytonia* L. s. lat. (forming the subfam. *Montioideae* in *Portulacaceae*) there are some species which have not consistently been placed in the same genus. For this reason the limit between the two genera has become diffuse and almost impossible to define. Useful characters seem to be lacking or have proved to be untenable. In connection with this PAX & HOFFMANN (1934, p. 243) noted, "Die Gattungen der Familie sind sehr nahe miteinander verwandt, besonders die um *Montia* gruppierten Genera, so dass es vielfach dem Ermessen des einzelnen überlassen bleibt zu welcher Gattung manche Arten zu stellen sind".

These ambiguous species have often formed sections of their own. From earlier models (TORREY & GRAY 1838, pp. 198—202) v. POELLNITZ (1932, p. 280) divided *Claytonia* into ten sections, while PAX & HOFFMANN (1934, p. 259) gave *Claytonia* a narrow range (including three sections, *Claytonia*, *Caudicosae*, and *Rhizomatosae*) but divided *Montia* in seven sections (*Montia*, *Limnia*, *Alsinastrum*, *Naiocrene*, *Montiastrum*, *Limnalsine*, and *Australienses*). The sections include according to both authors the same species. Some of these sections

were transformed into genera by RYDBERG (1932, pp. 279—80). Beside *Montia* and *Claytonia* s. str. he distinguished five new genera from North America, *Crunocallis* Rydb., *Limnalsine* Rydb., *Limnia* (L.) Haw., *Montiastrum* Rydb., and *Naiocrene* Rydb. Except for *Limnia* they include only a few species or are monotypic.

By adding a series of characters new to these genera, from cytological, biological, and pollen morphological studies and more detailed morphological investigations, it has been possible to give them a fixed and natural limitation. The limits for the genera, after some rearrangements follow closely the division proposed by RYDBERG. Rearrangements have been necessary in e.g. *Claytonia*, which also has to include the genus *Limnia* (as a section). After this, *Claytonia* forms a distinct genus which is in my opinion more related to the North American genus *Lewisia* Pursh than to the other genera of this subfamily. These genera also form distinct units, which can be distinguished by a series of characters. The division proposed is well supported by various data from gross morphology, pollen morphology (with several important characters) and cytology (different basic numbers and different morphology of the chromosomes).

Besides the North American taxa there are two species known from Australia and South America respectively, which cannot be placed in *Montia* or *Claytonia* or any of the other genera. They are distinguished as two new genera, which will be described here. Both occur in territories which are geographically separated from that of the other genera (except the cosmopolitan genus *Montia*). One of them has its distribution in SE. Australia and New Zealand. The other one is newly described (1954) and occurs in an isolated mountainous area in the northern part of South America.

The drawings of details of the organs that illustrate this article follow preparations that are made transparent and stained by safranin, in order to make the vascular tissue clear. The pollen preparations have been prepared by the Palynological Service Institution in Solna, Sweden.

### **Mona Ö. Nilss. gen. nov.**

(*Portulacaceae* — subfam. *Montioideae*, affinis *Montia* L.)

*Claytonia* L. § *Alsinastrum* Torr. & Gray 1838, p. 201, p. p.;

*Montia* L. sect. *Alsinastrum* (Torr. & Gray) Pax & Hoffm. 1934, p. 259, p. p.;

cp. FRIEDRICH 1954, p. 458.

Herba perennis, laxe caespitosa. Caules prostrati, breviter repentes; caules floriferi erecti. Folia surculorum steriliū opposita; folia caulium floriferorum nulla vel 1—2, alternantia, anguste obovata vel spathulata, apice rotundata, margine scarioso hyalino angustissimo praedita, basi membranacea late dilatata, ± vaginata, subsucculenta. Inflorescentiae terminales (vel laterales), densae, subumbellatae. Flores numerosi. Bractae ad basin inflorescentiae conglomeratae, numerosae, margine undulatae, late ovatae, membranaceae, acumine ± breviter virides. Pedunculi elongati. Pedicelli post anthesin erecti, applanati. Folia involucri ovata, acuminata, capsulam superantia. Tepala 5, breviter spathulata, quam involucrum paullo longiora, omnia basi longe connata, aequalia, luteoalba; tubus perianthii post anthesin uno latere fissus, ad maturationem fructus persistens. Stamina 5; filamenta omnia basi dilatata, connata. Stylus a capsula distincte separatus, tribus stigmatibus. Capsula oblonga ovata, acuminata. Semina 3, verrucosa. Grana pollinaria 12-pantocolpata, intectata, reticulata.

The genus is monotypic. For further descriptions, see under the species.

Type species: *Mona meridensis* (Friedrich) Ö. Nilss.

*Mona meridensis* (Friedrich) Ö. Nilss. comb. nov.

Orig. coll.: VARESCHI no. 2096 (M, holotype).

*Montia meridensis* Friedrich 1954, pp. 457—58.

Perennial, laxly caespitose herb. Stems few (1—3), 5—7 cm. long, erect; at basal part of stem 2—7 nonflowering shoots, up to 12 cm. long, usually not further branching, decumbent, often rooting at nodes; from apical part of stem 1—5 closely standing inflorescence-bearing branches. Leaves on stem and nonflowering shoots decussate, on prostrate shoots opposite and in one plane; leaves on inflorescence-bearing branches lacking or sometimes 1—2, alternate; leaves narrowly obovate—spathulate, obtuse, 10—20 mm. long, with one distinct hydathode at apex, subsucculent; petioles lacking or very short, not distinct, laminae narrowly white-margined by broad hyaline cells; leafbase much dilated, scarious, with opposite leafbase shortly sheathing. Stomata on both sides of leaf, sparsely on underside, distinct accessory cells lacking, guard cells with one straight, thin external and one very short internal fold; epidermal cells with undulating walls. Inflorescences few, terminal, sometimes together with 1—2 small lateral ones, close, umbelliform, bracteate, main axis of inflorescence very short (fig. 1 : A). Peduncle 5—20 mm., somewhat elongating after anthesis. Flowers 10—20 (seldom fewer) per inflorescence, flowering almost simultaneously. Bracts 5—10



(innermost flowers without bracts), broadly ovate, shorter than pedicels; basal bracts  $\pm$  leaflike, but always sessile, obtuse, and more dilated at base, apical ones quite scarious, shorter, acute, between these gradual transition (fig. 2; cp. below); basal bracts usually closely standing, surrounding flowers like a cup. Pedicels 3—7 mm. accrescent, after anthesis erect, flattened and alate, at apical end gradually dilating without sharp limit towards flower. Involucral leaves  $\pm$  unequal (inner somewhat longer), c. 2.5 mm. long, broadly deltoid, acuminate, with diverging tips, keeled, like inner bracts with undulating margin, much exceeding capsule (fig. 1: D). Tepals 5, equal, 2.5—2.8 mm., somewhat longer than involucre, broadly spatulate; lamina almost orbicular, obtuse; erect or somewhat inflexed at anthesis, with one coarse midrib, yellowish—white; petioles distinct, rather long ( $\frac{2}{3}$  of tepals), all united at base to  $\frac{1}{3}$ , forming a tight tube,  $\pm$  completely splitting between internal two tepals after anthesis (fig. 1: B). Stamens 5, about  $\frac{4}{5}$  of tepals, equal; filaments flattened and dilated at base, united to an inner tube, on distal side to  $\frac{1}{3}$  adnate to tepals; free parts of filaments c. 1 mm.; connective fixed at centre of anther, between lobes; anther short, 0.2—0.3 mm.,  $\pm$  sphaeroid, latrorse; stamens and tepals persistent until fruiting (fig. 1: D). Pollen grains, see below. Style short, about  $\frac{2}{3}$  of ovary, thick, very distinct from ovary, falling off after anthesis. Stigmata 3, thick and rather long, erect or somewhat diverging at anthesis; papillae thin, closely placed only on inner side of stigmata (fig. 1: C). Capsule fusiform, about 2 mm.; valves 3, at middle of their commissure one short, verruciform swelling, below them deeply 3-sulcate; valves at maturity stellately splitting to swellings, bending perpendicularly outwards (fig. 1: E). Seeds 3 (or fewer), laterally somewhat flattened, broadly obovoid, very small, c. 0.6 mm.; attachment plate delimited, flat with a distinct, yellowish white, flat strophiole; testa verrucose with distinct, orbicular, irregularly arranged, uniform, blunt tubercles; rather shiny; keel evenly rounded (fig. 1: F).

Illustrations: FRIEDRICH 1954, p. 457 and my figs. 1 and 2.

### Discussion:

After the description of *Montia meridensis* FRIEDRICH (1954, p. 458) remarks that the species in its vegetative parts is reminiscent of the genus *Montia*, but in its flowers more of *Claytonia*. In regard to his difficulties in placing the species he adds, "die Inordnung zu einer der beiden Gattungen bereitet daher Schwierigkeiten". He also remarks that the limit between the two genera is vague. However, with some

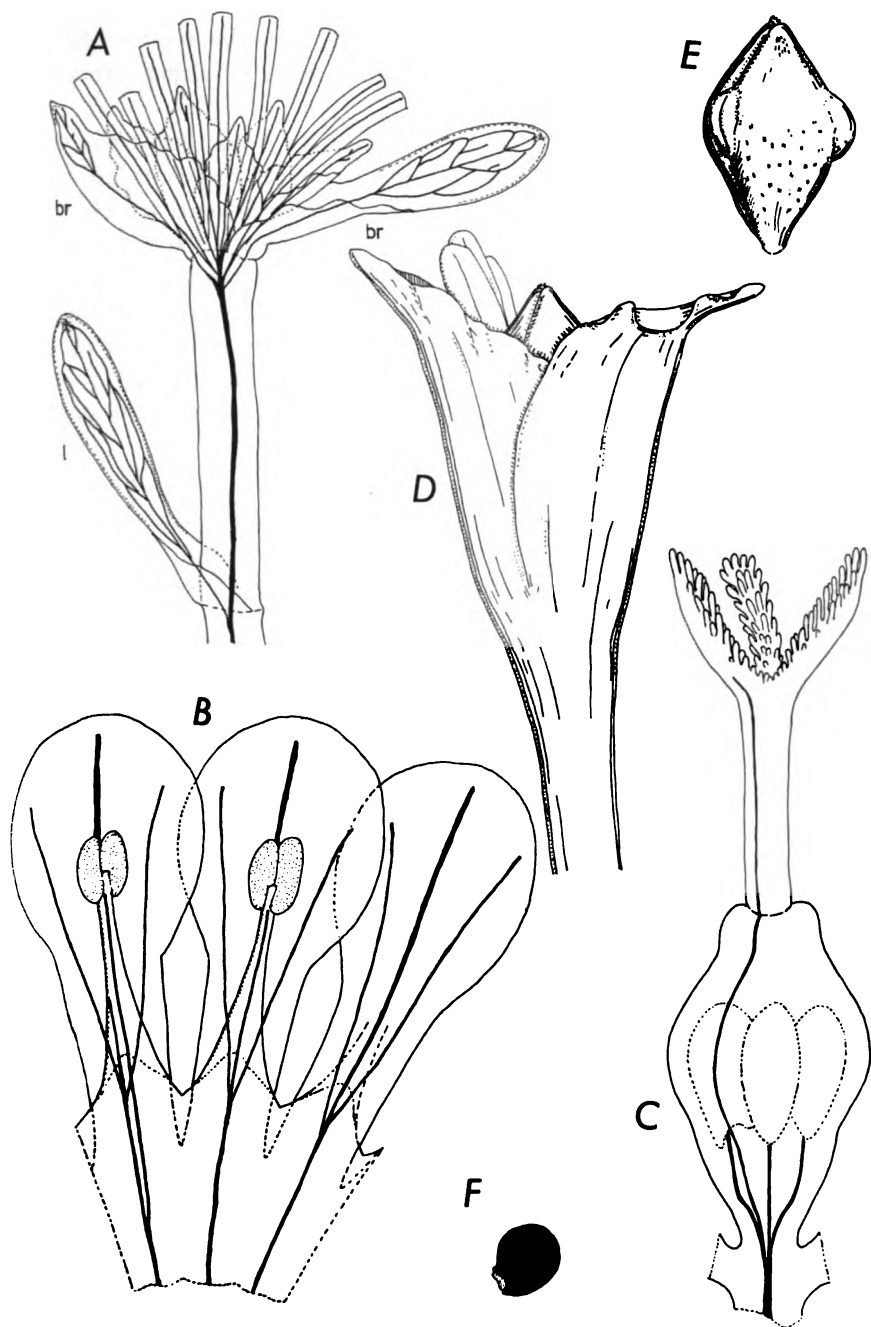


Fig. 1. *Mona meridensis* (Friedrich) Ö. Nilss. — Colombia, M. T. DAWE no. 718 (K).  
 — A: Inflorescence (br=bracts, l=leaf). — B: Tepals and Stamens. — C: Pistil.  
 — D: Involucre and Capsule. — E: Capsule. — F: Seed.

hesitation the species is placed in *Montia* and in the section *Alsinastrium*, "wenngleich sie auch dort eine isolierte Stellung einnehmen muss".

In order to distinguish the genus *Mona* from the two genera *Montia* and *Claytonia*, see tab. 1, where some important characters are compared. Besides these characters there are some which are  $\pm$  representative for the genus *Mona*: e.g. the leaves with their distinct white margin; the umbelliform inflorescence with many closely standing flowers flowering almost simultaneously; the flattened pedicels; the acute and keeled involucreal leaves with their undulating margin; the form and colour of the persistent tepals; the splitting of the corolla after anthesis, the form and opening of the capsule. Cp. below, pollen morphology, and distribution.

The genus *Mona* is distinguished from both *Montia* and *Claytonia*. In some respects it seems however that it has more characters in common with *Montia*. But the new genus is imperfectly known — nothing about its biology and cytology and very little from its ecology — and therefore it is almost impossible to draw any further conclusions about its relationships.

In *Mona* the bracts are many but usually fewer than the pedicels. The pedicels are 10—20 but the bracts only 5—8. The basal bracts stand opposite the lower pedicels, or sometimes lateral inflorescences.

The basal bracts are leaf-like. But at the base they are more dilated and scariose than an ordinary leaf and the lamina is somewhat shorter (fig. 2). The vascular tissue also has the same arrangement, one central vein and two marginal connected at the apex and by costal veins. From the basal bracts there is a transitional diminution series to the uppermost bracts. In this series the green lamina is gradually smaller. The uppermost (or internal, the main axis of the close cyme is very short) bracts have no green parts and are quite scarious and acute. Sometimes the hydathode at the apex of the central vein can remain surrounded by some mesophyllic tissue. Parallel with the diminution of the lamina there is a decrease of the vascular tissue. In the first place the costal and marginal veins or parts of them are reduced. In the uppermost bract there is only a short unbranched central vein.

Between the uppermost bracts and the two involucreal leaves there are many similarities, e.g., in shape. However the involucreal leaves are quite green and the vascular tissue is rather well developed. They have one central vein but also two vigorous lateral ones which are not united

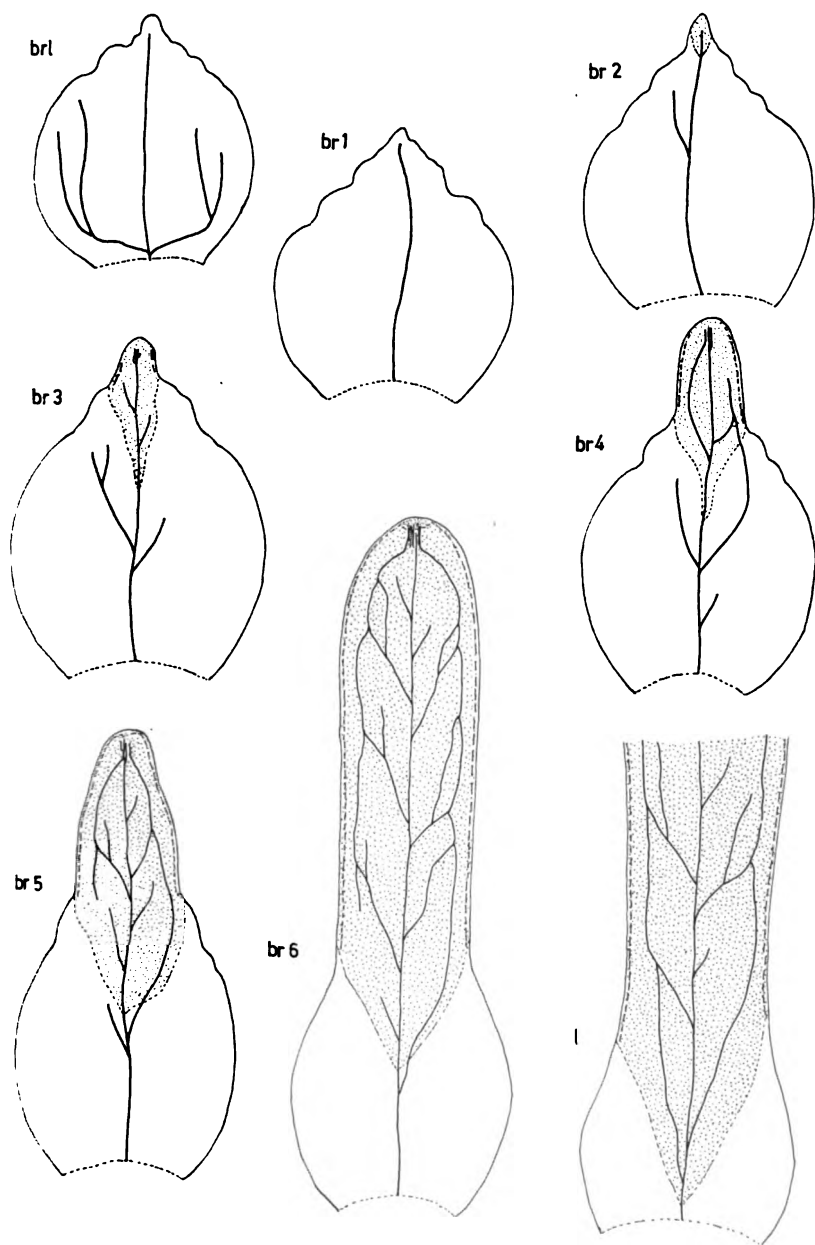


Fig. 2. *Mona meridensis* (Friedrich) Ö. Nilss. — Bracts in Series from one Inflorescence (brl=one of the involucre leaves; br 1—6=bracts, 1 the innermost; l=base of an ordinary leaf; dotted=green parts, brl, is all green).

Tab. 1. Comparison in Some Important Characters of the Genera *Claytonia*, *Mona*, *Paxia*, and *Montia*

Organs and Characters	<i>Claytonia</i>	<i>Mona</i>	<i>Paxia</i>	<i>Montia</i>
Stem; mode of growth .....	erect	ascending	creeping	erect or ascending
internodes of stem .....	not elongated	every second elongated	elongated	every second elongated
Leaves; position .....	alternate, in close rosette	decussate	alternate	decussate
Stomata: position on leaves .....	both sides	both sides	both sides	dorsal side
accessory cells .....	2—4 on each side	lacking	one on each side	lacking
guard cells .....	ex- and internal fold	ex- and thin internal fold	ex- and internal fold	thin external fold
Inflorescences; position .....	lateral, from special branches	terminal (or lateral)	lateral	terminal or lateral
peduncle .....	developed	developed	developed	lacking
bracts .....	0—many	many	many	one
main axis .....	developed	very short	developed	developed or short
pedicels (position after anthesis) .....	often reflexed from base	erect	bow-like recurved	hook-like
Flowers; tepals .....	5, equal	5, equal	5, equal	5 or 2, 2 longer
apex .....	emarginate	obtuse	obtuse	obtuse—acute
at base .....	very shortly united	broadly united	broadly united	broadly united, one lateral split
stamens .....	5, 2 shorter	5, equal	5, equal	3 (or 5)
filaments .....	free	united at base	broadly united	free
anther (opening) .....	extorse	latrorse	extorse	introrse
style .....	long	rather long	long	almost lacking
stigma .....	papillae on inner side	papillae on inner side	papillae on inner side	papillae all around
ovules .....	6 or 3	3	3	3
Flowering .....	protogynous or protandrous	—	protandrous	homogamy, often cleistogamous
Capsule; form .....	obovoid—ovoid	fusiform	globular	broadly obovoid
swellings .....	ridge-like	verruciform	ridge-like	lacking
dehiscence .....	to swellings	stellate to swellings	to swellings	to base
Seeds; attachment plate .....	indistinct, concave	swellings	distinct, flat	distinct, flat
strophiole .....	tap-shaped	flat	flat	flat
keel .....	sharp	even curved	even curved	even curved
Pollen grains; colpi .....	3	12	30 (—36)	12 (—25)
Chromosomes; 2n .....	tectate	intectate	tectate	tectate
length (abs.) .....	12, 24, 36, 48, and aneuploidy (x 6 or 7)	—	96	20, 40
	7 13 "	—	0.5 1.5 "	1.0 2.0 "

at apex. They are arranged after a pattern (a system branched from base without costal veins) found in the same organ among species from various parts of the family. They have no white margins.

In the bracts there seems to be a reduction of the vascular tissue closely following the diminution of the green parts. Following an incessant function the veining is reduced until standing only as a support for the quite scarious tissue in the innermost bracts. No other remnants are left.

The basal — and external — bracts surround the pedicels of the umbelliform inflorescence like a cup-shaped involucre. The inner ones are placed between the pedicels. Sometimes one or two of the basal bracts are alternately placed at some distance from the other. They are usually standing opposite a small lateral inflorescence.

### Pollen morphology

Diagnosis (for the terminology cp. ERDTMAN 1952, pp. 459—72 and 1963, pp. 16—39):

*Mona meridensis*, collection: Colombia, M. T. DAWE no. 718 (K).

(Fig. 5 : A, B.)

Pollen grains pantocolpate; spherical, diameter 35—39  $\mu$ .

Colpi 8—12  $\mu$  long, rather broad; colpi 12, delimiting six  $\pm$  regular quadrangles. Margins inflated.

Aperture membrane thin, crustate, with coarse, rather long processes in one rather broad row.

Sexine intectate, retipilate, 2.2—2.6  $\mu$  thick,  $\pm$  uniform in thickness. (Tectum, spinulae, puncta 0.) Bacula about 2.5  $\mu$  long, rather coarse, uniform in length, pilumlike, distally united two and two or few, closely and regularly placed in a coarse meshed reticulum.

Nexine about 1.1  $\mu$  thick.

### Discussion:

Considering the pollen grains *Mona* is distinguished from the other genera of the subfamily examined. Pollen grains from this genus are so characteristic that they may be regarded as a particular pollen type — the *Mona*-type. The most prominent feature of this type is the structure of the sexine.

The sexine is intectate, a character that is unique within the whole family. The bacula are standing in a distinct reticulum, that has not been found among the other genera of the subfamily *Montioideae*. The bacula are all  $\pm$  uniform in length and thickness. This is always the case within the other subfamily *Portulacoideae*. Within *Montioideae*

it is only known to occur in one other genus but in a somewhat different manner. The pollen grains of the *Montia*-type are characterised by bacula that are not uniform. They are longer and coarser and distally branched in the central part of the mesocolpate area, while those peripherically placed are thin and usually unbranched and more closely placed.

However the aperture conditions indicate that there are some similarities between the *Mona*- and the *Montia*-types. Both have 12 colpi arranged after the basic scheme (colpi delimiting six regular quadrangles on a sphere) and usually only one row of processes on the aperture membrane. The *Mona*-type differs clearly from the *Claytonia*-type (3-colpate, only found within the genus *Claytonia* s. str.).

### Distribution and Habitat

The species has been very sporadically collected. The few collections have been made in the mountains of the borderland between Venezuela and Colombia (fig. 6: A), in the Cordillera do Merida and the Sierra Nevada — two mountain regions separated by a low lying area.

According to FRIEDRICH (1954, p. 458) *Mona meridensis* grows on moist and mossy ground in the subalpine Paraños-vegetation at altitudes of c. 3500—3750 m.

Specimens examined from the two distribution areas are all very alike.

Flowering period: About November and December.

### Collections examined:

Venezuela, Est. Merida, Laguna Mucubajé, 3750 m. s.m., VARESCHI no. 2096, 1952 (M); as the former but VARESCHI no. 2096 a (M); Venezuela, VARESCHI no. 1238 (M); Colombia, Sierra Nevada, 3500 m., M. T. DAWE no. 718, 1917 (K).

### *Paxia* Ö. Nilss. gen. nov.

(*Portulacaceae* — subfam. *Montioideae*, affinis *Montia* L. et gen. al.)

*Claytonia* /Gronov./ L. p.p. in Hooker 1840, tab. 293;

*C.* sect. *Australienses* v. Poellnitz 1932, p. 282;

*Montia* /Mich./ L. sect. *Australienses* (v. Poellnitz) Pax & Hoffm. 1934, p. 259.

Herba perennis, dense caespitosa. Caules depressi, longe repentes, internodia longa vel brevissima. Folia alterna, erecta, valde variabilia, subspathulata vel elongato-linearia, apice acuta vel obtusa vel  $\pm$  emarginata, basi late scariosodilatata, succulenta. Stomata in utroque latere folii. Inflorescentiae erectae, laterales, 1—7-florae. Bractae pedicellis oppositae, numerosae, scariosae, acutae. Pedunculi  $\pm$  elongati. Pedicelli post anthesin media parte cur-

vati. Folia involucri obtusata, quam capsula breviora. Tepala 5, involucrum ad quadruplum superantia, late obovata, obtusa, omnia basi connata, aequalia, alba vel roseoalba. Stamina 5, omnia basi filamentum lato inter se connata. Stylus stamina aequans, tribus stigmatibus brevissimis. Capsula globosa. Semina 3, sublevia, nitida. Grana pollinaria 30- pantocolpata,  $\pm$  syncolpata.

The genus is monotypic. For further descriptions, see under the species.

Type species: *Paxia australasica* (Hook. f.) Ö. Nilss.

*Paxia australasica* (Hook. f.) Ö. Nilss. comb. nov.

Orig. coll.: Circular Head, Hampshire Hills (Tasmania), R. GUNN 1837 (no. 160), (K, lectotype); cp. HOOKER 1840, tab. 293 left figure.

*Claytonia australasica* Hook. f. 1840, tab. 293; *Montia australasica* (Hook. f.) Pax & Hoffm. 1934, p. 259.

*Claytonia calycina* Colenso 1896, p. 592 (orig. coll.: N. Zealand, Ruahine Mountain range, A. OLSEN 1895, WELT lectotype); *Montia calycina* (Colenso) Pax & Hoffm. 1934, p. 259.

Perennial herb, densely caespitose and stoloniferous, sometimes forming  $\pm$  close mats or low soft cushions with a diameter of 20—50 cm. Stems and leafy shoots procumbent or creeping on or usually below ground, rooting at nodes, 10—35 cm. long, with rich monopodial branching, branches ascending; internodes varying in length, in autumn often forming swollen, up to 2 cm. long, starch storing white tubers (organs for hibernation). Leaves alternate from prostrate stems, ascending from base, erect, always alternating regularly from both sides of stem, on ascending shoots in spiral arrangement; because of short internodes sometimes very closely placed (cp. COLENZO 1896, p. 592), leaves usually longer than internodes; youngest two or three leaves in apical part of shoots hook-like, recurved (fig. 3: A<sub>2</sub>), foremost leaf bending over shoot-apex; leaves narrowly spatulate-linear, varying much in length and breadth, 2—12 cm. long, seldom over 4 mm. broad,  $\pm$  obtuse or seldom acute or emarginate; with one large, well developed hydathode at apex; succulent, with  $\pm$  homocentric mesophyll; petioles not distinct, equalling lamina or longer; leafbase much dilated, scarious, shortly sheathing, persistent. Stomata sparsely on both sides of leaf, accessory cells distinct, one lateral on both sides of stomata; guard cells with one external and one internal rather distinct fold; epidermal cells elongated, ordered after length of leaf, walls thin, not or only slightly undulating. Inflorescences numerous, erect, lateral and axillary, directly from prostrate stems or from ascending branches, lax, cymose,



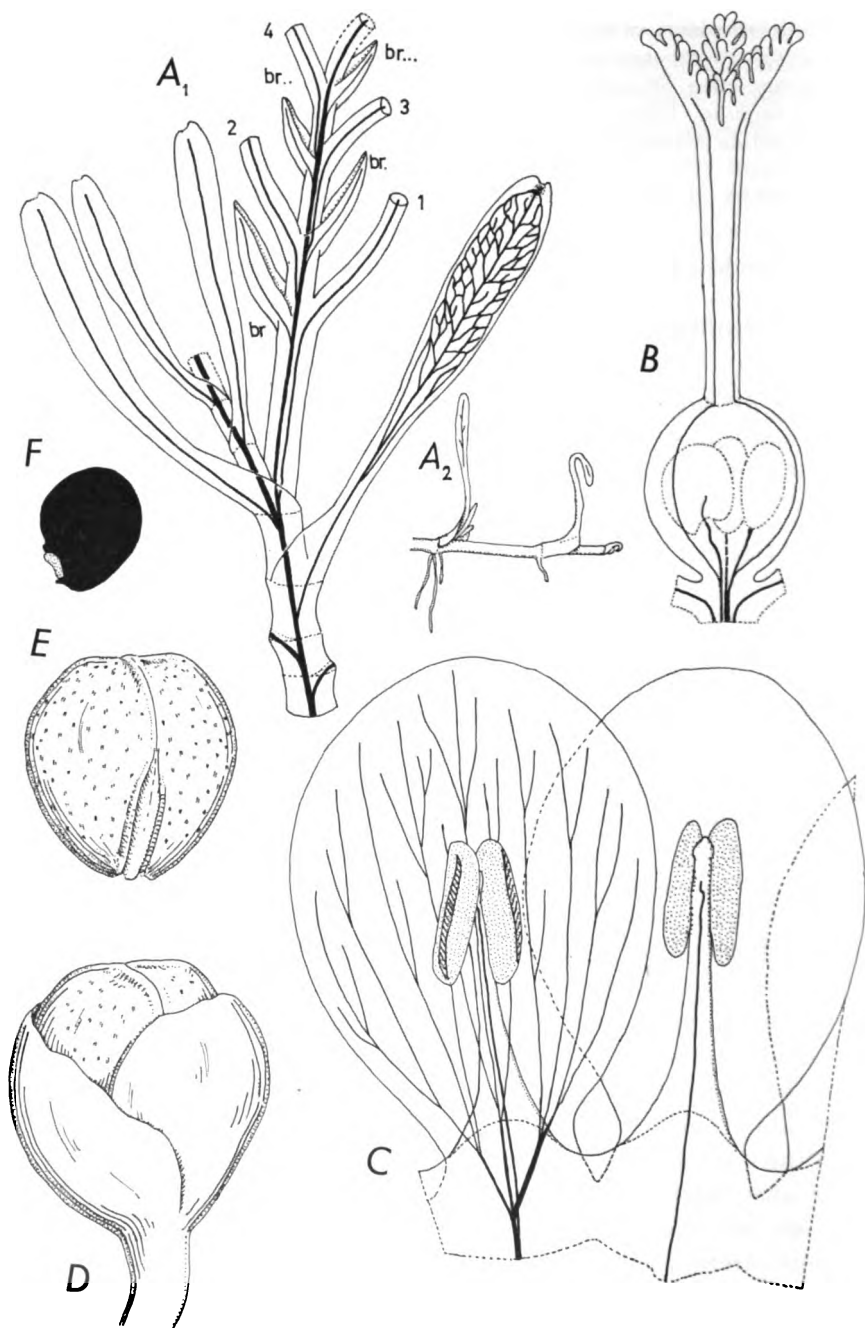


Fig. 3. *Paxia australasica* (Hook. f.) Ö. Nilss. — Australia, Capit. Territ., Mt. Bimberi, P. DARBYSHIRE no. 123 (K). — A<sub>1</sub>: Inflorescence (1—4=pedicels, br=bracts). — A<sub>2</sub>: Apex of Shoot. — B: Pistil. — C: Tepals and Stamens. — D: Involucre and Capsule. — E: Capsule. — F: Seed.

main axis developed, of varying length, bracteate (fig. 3: A<sub>1</sub>). Peduncle developed, 1—4 cm. long. Flowers 1—7 per inflorescence, flowering in succession. Bracts equal to flowers or sometimes fewer, opposite to pedicels, well developed at base, entirely scarious or sometimes green-tipped, almost as long as pedicels, apical in succession smaller, scarious; broadly ovate, acute, sessile, dilated at base, shortly sheathing. Pedicels varying in length, 6—30 mm., terete; after anthesis bow-like, recurved. Involucral leaves equal, 2—5 mm., broadly ovate, rounded at apex, somewhat shorter than capsule (fig. 3: D). Tepals 5, equal, 6—9 mm. long, 2—3 times longer than involucre, obovate,  $\pm$  deflexed at anthesis, white or sometimes rosy; petioles rather distinct, very short, all united to half length (fig. 3: C). Stamens 5, equal,  $\frac{2}{3}$  of tepals; filaments at base shortly adnate to tepals, at base much dilated forming a short tube, free parts of filaments c. 4—5 mm. (fig. 3: C); connective fixed near apex of anther, on inner side of lobes; anther c. 2 mm., ovoid, extrorse; protandrous; stamens and tepals fading directly after anthesis. Pollen grains, see below. Style long, about twice the ovary, distinct from ovary, falling off after anthesis. Stigmata 3, very short, somewhat diverging at anthesis; papillae coarse, sparsely placed only on inner side of stigmata (fig. 3: B). Capsule  $\pm$  globular, c. 4 mm.; valves 3, from middle of their commissure one long, ridge-like swelling (fig. 3: E); valves at maturity dehiscent to swellings, diverging. Seeds 3 (or fewer), somewhat laterally flattened, obovoid, 1.2 mm.; attachment plate narrowly delimited, somewhat concave with distinct yellowish white, flat strophiole; testa smooth with indistinct, irregularly arranged cells; shining; keel evenly rounded (fig. 3: F). Chromosome number  $2n=96$  (in 5 collections, see below); karyotype with small chromosomes (about  $1.5 \mu$ ), longest about twice the smallest, most metacentric, centromeres  $\pm$  indistinct, no satellite bearing chromosomes observed (fig. 4).

Illustrations: HOOKER 1840, tab. 293 and my figs. 3 and 4.

Determination of the chromosome number and studies of the karyotype have been made in mitoses from root tips; the Svalöv modification of Navashin-Karpechenko's fixative followed by a standard crystal violet staining have been used, without any pretreatments. Following material has been examined (cultivation numbers):

a. plants after seeds from herbarium specimens;

1. Fog Peak, Torress Range, S. Isl., New Zealand, 1959, ASCHWIN no. 793, SMU (MN 425).
2. Summit of Mt. Bimberi, Capit. Territ., Australia, 1961, DARBYSHIRE no. 123, K (MN 400).

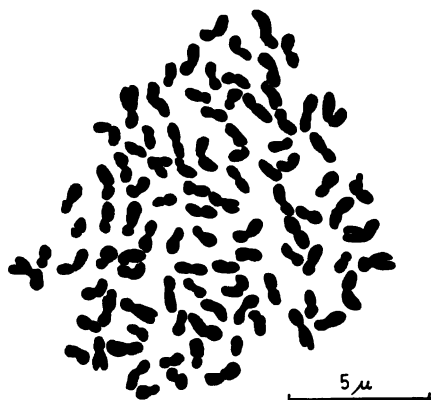


Fig. 4. *Paxia australasica* (Hook. f.) Ö. Nilss. — Homeridge, Marlborough, S. Isl., New Zealand, M. SIMSON 1954 (cult no. MN 408). — Mitosis in root tip ( $2n=96$ ).

3. Mt. Egmont, N. Isl., New Zealand, 1955, HAMLIN no. 428, WELT (MO 73, 1—5).

b. plants after rhizomes received from Christchurch, Bot. Garden;

Homeridge, Molesworth, Marlborough, S. Isl., New Zealand, 1954, M. SIMSON (MN 408, 1—8).

#### Discussion:

Owing to the taxonomic place he gave the species HOOKER wrote (1840, in his commentary to tab. 293), "There can, I think, be no doubt of its being a true *Claytonia*, very different from any hitherto described, and as far as I can distinguish, the first species that has been detected in Australia, or even in the southern hemisphere".

v. POELLNITZ (1932, p. 282) placed the species in a section of its own of *Claytonia*, sect. *Australienses*. By PAX & HOFFMANN (1934, p. 259) this section and the species was transferred to *Montia*.

For a comparison in some important characters of the genus *Paxia* and the two genera *Montia* and *Claytonia*, see tab. 1. There are however, some features which are characteristic for the genus *Paxia*: e.g. the long, creeping much branching stems, forming mats or cushions; the erect leaves, forming a recurved hook above the apex of the shoot; the almost straight walls of the epidermal cells; the homocentric arrangement of the mesophyll; the short stigmata; the high chromosome number (in this probably highly polyploid plant the basic number is difficult to decide), and the metacentric chromosomes. Cp. below, the pollen morphology and the distribution.

After this comparison it should be observed that it seems that the genus *Paxia* has a closer affinity to *Montia* than to *Claytonia*. This is

especially indicated by the resemblance in the pollen morphology and in the cytology.

#### Variation:

The herbarium specimens examined of *Paxia australasica* present a wide morphologic variation. Much of this variation seems to be caused by the great plasticity of the species in its modification or adaption to different environments. The vegetative parts show the greatest variation — the length of leaves and stems and the prolongation of the internodes of stem and inflorescences. The plants seem to be altered with the most conspicuous results by a varying degree of moisture and a varying altitude of the localities. The variation is not limited to any special places. It seems to be the same on corresponding localities from the whole area of distribution.

Plants of a clone of the species (MN 408) has been cultivated. With varying watering for every plant it has been possible to get modification forms which cover most of the variation found. Some plants were placed under varying light which also resulted in a wide morphologic variation. The plants show a remarkable plasticity. They are much elongated in water, when dry they are shorter and stouter. With much moisture the inflorescences are well developed with several flowers, under dryer conditions only one or few crowded flowers develop. Collections from four different places have been cultivated. They are all very much alike under identical conditions. Under varying conditions they show a similar plasticity.

However the whole variation does not seem to be dependent only on the modification of the plants. Within the species there is also a variation that has genetical reasons. It is easy to observe in the floral parts, e. g. in the length and colour of the tepals, the length of the stamens in relation to the tepals, the form of the capsule etc. Within the wide ecological variation there may also be an ecotype differentiation that is partly concealed by the modification forms. The solution of this problem, however, needs comparative cultivation of a great plant material from varying localities and further local investigations. In herbarium material it seems impossible to distinguish any distinct types.

Some of the variation types within the species have been subjected to taxonomical treatment (BUCHANAN 1871, p. 210 and ALLAN 1961, p. 220). Taxa have been described as varieties, e.g. var. *biflora* Buch., var. *racemosa* Buch., var. *sessiliflora* Simpson and var. *uniflora* (Travers, nom. nud., cp. below). Some of these varieties are as far as it has been possible

to examine modifications to different environments. Very similar forms have been seen from many places. Some of them (e.g. var. *biflora*) are very much like some of the modifications that arose under cultivation. The most distinct varieties (e.g. var. *sessiliflora*) seem to be dry-modifications and are distinguished by crowded leaves in consequence of short internodes and few flowered inflorescences with short pedicels.

COLENZO (1896, p. 592) described *Claytonia calycina* from New Zealand. This species was accepted by v. POELLNITZ (1932, p. 316) and by PAX & HOFFMANN (1934, p. 259). According to the many peculiarities in the description of COLENZO, they accepted the species with much hesitation. They did not examine the type material. Among the doubtful characters of that description only two should be observed here, the occurrence of a bifid stigma and a pair of stipules at every leaf (characters that do not occur elsewhere in the family). The type specimen is a form which falls well within the variation of *P. australasica*. The stigmas are normally trifid and stipules are lacking (perhaps the dilated and scarious bases of the leaves have been mistaken for stipules).

In regard to the vigorous vegetative propagation of the species most of the plants within  $\pm$  restricted areas probably belong to one single clone. The seed setting is good, usually the capsules of examined specimens contain three seeds. Under greenhouse cultivation the fruiting is bad or usually failing. After isolation of single flowers there were no seeds at all. When pollen from one flower was brought into contact with its own stigma there was however good seed setting. In consequence of this fact it seems that self pollination is not the best way to fertilization, though it is not impossible, and gave with some assistance the same result in fruiting as cross pollination. Under natural conditions cross pollination is predominant, considering the strictly protandrous flowers and the variable progeny obtained from a single plant.

### Pollen Morphology

#### Diagnosis:

*Paxia australasica*, collection: N. Zealand, 1899, W. PETRIE (CHR). (Fig. 5: C—E.)

Pollen grains pantocolpate; spherical, diameter 40—44  $\mu$ .

Colpi 12—15  $\mu$  long; colpi 30 (or sometimes c. 36), delimiting  $12 \pm$  regular pentagons, usually completely syncolpate or with most colpi continuous.

Aperture membrane rather thick, crustate, with small, rather low verruca-like processes in two or seldom three regular rows.

Sexine tectate, 3.2—4.0  $\mu$  thick in central part of mesocolpia, gradually

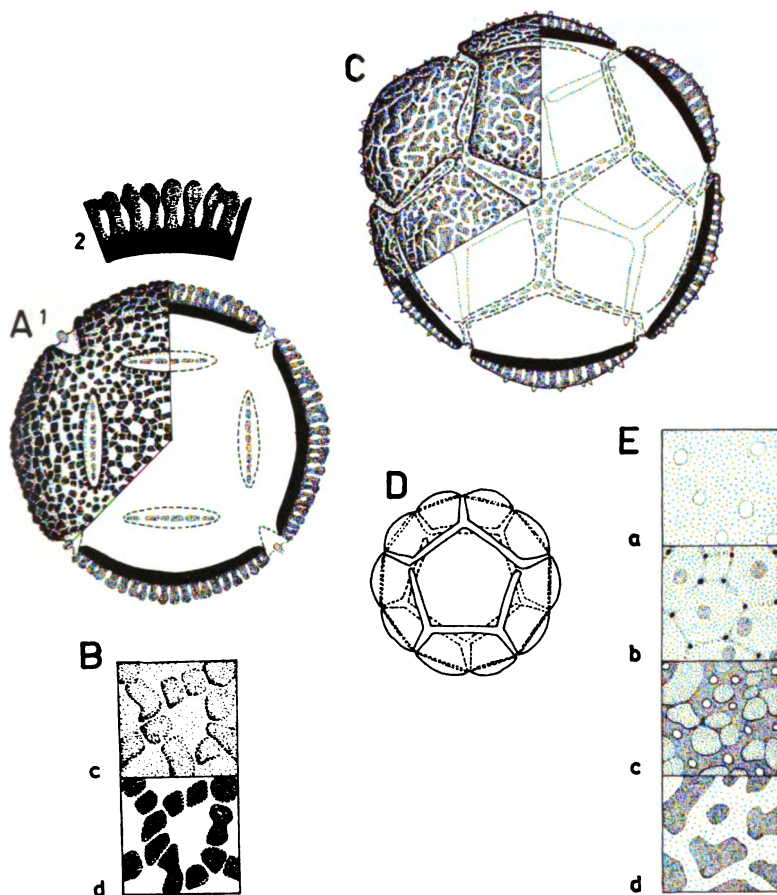


Fig. 5. *Mona meridensis* (Friedrich) Ö. Nilss. (A—B) and *Paxia australasica* (Hook. f.) Ö. Nilss. (C—E). — A<sub>1</sub> and C: Palynograms. — A<sub>2</sub>: Sporoderm in section. — B and E: LO-analyses. — D: Arrangement of Colpi.

thinner towards colpi. Tectum with rather small ( $0.7\text{--}1.1\ \mu$  high), densely placed spinulae. Puncta small but distinct. Bacula in central part of mesocolpia about  $2.5\ \mu$  long, rather coarse, at distal end dilated and branched, often united to each other and tectum to long, irregularly winding plates; bacula towards colpi shorter, thinner and more closely placed.

Nexine c.  $1.2\ \mu$  thick.

#### Discussion:

Because of the pollen grains the genus *Paxia* is distinguished from the other genera of the subfam. *Montioideae*. *Paxia* has pantocolpate pollen

grains like most genera of that subfamily. But the number of colpi differs. It has been regarded as an important character. Therefore pollen grains from this genus form a particular pollen type — the *Paxia*-type.

Colpi are usually 30 (or more), i.e., the highest number found in this subfamily. Colpi are arranged round 12 regular pentagons (sometimes when colpi are more than 30 the pentagons are mixed with some few hexagons after particular patterns) on a sphere after the secondary basic scheme (in the primary basic scheme for pantocolpate pollen grains in this family, 12 colpi are arranged in six regular quadrangles and it is typical of e.g. the *Montia*-type; from this primary basic scheme the secondary is derived over intermediate forms with quadrangles and pentagons mixed).

Usually the pollen grains are completely syncolpate, or if not, the syncolpate tendency is very strong. This has not been noticed among the other pollen types in *Montioideae*. In *Montia* the maximum length of colpi is 12  $\mu$ , in *Paxia* it is 16  $\mu$ . The aperture membrane has small processes in two or three rows in the *Paxia*-type. In the *Montia*-type the processes are coarser and usually placed only in one row.

In the structure of sexine the *Paxia*-type shows many resemblances to the *Montia*-type. However, small differences occur in, e.g., the type of the distal uniting of the bacula.

It should be noted that there are great differences between the *Paxia*-type and the 3-colpate pollen grains of *Claytonia*. The pollen grains of the *Paxia*-type and the *Montia*-type are similar in many respects, e.g. in the structure of sexine and the aperture conditions. Perhaps it indicates some phyletic connection between the two genera.

#### Distribution and Habitat

*P. australasica* occurs in Australia in the southern part of the Austral-ian Alps. It has been collected in E. Victoria, SE. New South Wales and the Capital Territory. Most collections are from the Mt. Kosciusko massif. The species is also known from the mountains of Tasmania. On the South Isl. of New Zealand it is rather common. On the North Isl. it extends northwards to latitude 39° S., that is to the great mountains of Mt. Egmont and Mt. Ruapehu. *P. australasica* is common on the Campbell Isl. It has also been reported from the Stewart Isl., but the material (in WELT) on which this statement has been based is wrongly determined (fig. 6: B).



Fig. 6. Distribution of the two new genera, A: *Mona*, B: *Paxia*.

*P. australasica* usually occurs in mountainous district, on montane—subalpine(—alpine) levels. On Mt. Egmont it reaches up to an altitude of 2100 m. and on Mt. Kosciusko up to 2300 m. However on the east coast of the South Isl. and on Campbell Isl. the species has been recorded from low altitudes, near the sealevel. On Mt. Ruapehu it has been reported as the highest plant found (c. 2000 m.) forming small mats on loose shingle.

The species grows on localities with very varying moisture, occasionally on dry ground. It obviously prefers the damper places. According to notes of labels and other information (ALLAN 1961, p. 220) the species grows in localities of several kinds; in streams, on streambanks, in herbfields and wet grasslands, amongst tussocks, on cliffs, and near perennial snowdrifts. The soil has often been noted to consist of sand, gravel or shingle. The species has been reported to be calcifuge.

OLIVER (WELT) has noted the species in a *Ranunculus*—*Senecio* assn. at Blimit, New Zealand. HEINE (WELT) has remarked that *P. australasica* forms compact cushions on Mt. Hector (North Isl.) in a *Senecio*—*Olearia* assn. DU RIETZ (S) has noted the species for the alpine *Danthonia crassiuscula*-belt in a chionophilous vegetation at L. Harris in Fiord distr. (S. Isl.). It forms mats and cushions especially on places ± free from competition, bare sand on high altitudes, near streams etc.

Under greenhouse conditions *P. australasica* thrives well on a bed of moist peat.

**Flowering period:** *P. australasica* begins to flower on its northern localities about the end of November. On Mt. Egmont, at an altitude of 2000 m. flowering specimens have been collected from the end of December to the end of March; on Campbell Isl. from December



to the end of February. Flowering specimens have not been collected later than late March.

Under greenhouse conditions (in Lund, Sweden) the species begins to flower some of the first days in December. After that, one plant flowered  $\pm$  continuously for 7 weeks.

#### Collections examined:

Australia. — Nov. Holland. merid., Pl. Müllerianae (LD); Sidmouth and Emu Valleys, road to Bathurst, New Holl., AL. CUNNINGHAM (K). — Capit. Territory: Summit of Mt. Bimberi, 35°40'S., 148°48'E., P. DARBYSHIRE no. 123, 1961 (K). — New South Wales: Mt. Kosciusko, R. T. BAKER, 1893 (BRI); Mt. Kosciusko, J. H. MAIDEN & W. FORSYTH, 1899 (BRI); Mt. Kosciusko, C. SKOTTSBERG, 1949 (GB, S). — Tasmania: Van Diemens's Land, SCOTT (K); Hobart, G. CALEY, 1805 (BM); Circular Head, Hampshire Hills, R. GUNN, 1837 (K); Hobart, R. GUNN, 1840 (BM); St. Marys, A. SIMSON no. 1300, 1878 (BRI); Westbury, F. H. KENNY, 1909 (BRI). — Victoria: Melbourne (cult.) (BRI); Victorian Alps, C. WALTER, 1892 (BRI); Mt. Buffalo, H. C. E. STEWART, 1950 (BRI).

New Zealand. — Cave Camp, A. MORRIS JONES (WELT); Upper Matakai Plains, A. MORRIS JONES (WELT); Mt. Holomont, ZENIST (WELT); N. Zeal., H. IRYON (BRI); common at 2000', J. HECTOR (LD); Dun Mts., 4000', H. TRAVERS (v. *racemosa* Buch.) (WELT); Dun Mts., 4000', H. TRAVERS (v. *uniflora* nom. nud.) (WELT); Starvation Gully, L. COCKAYNE no. 2886, 1890 (WELT); Source, J. H. SPENCER, 1898 (WELT); Mt. Monatt, Awatere, I. KIRK no. 548, 1898 (WELT); N. Zeal., W. PETRIE, 1899 (CHR); Mt. Heelin, 1909 (WELT); W. R. B. OLIVER, 1911 (WELT); Dee Gorge, ex Herb. ASTON, 1916 (WELT); Dun Mts., M. A. EVERSLED no. 63, 1914 (BM); Waimuoin plain, H. CORSE, 1918 (WELT); Mengha valley, W. R. B. OLIVER, 1928 (WELT); Blimit cinque, W. R. B. OLIVER, 1928 (WELT); Blimit, W. R. B. OLIVER, 1928 (WELT); Mt. Arthur Tableland, Salisbury Plain, E. M. HEINE, 1933 (WELT); Takahe Valley, J. SORENSSEN, 1949 (WELT). — Campbell Isl.: B. C. ASTON, 1909 (WELT); N. of Windlows Bay, R. L. OLIVER, 1944 (WELT); Lyall-Beeman Snake, R. L. OLIVER, 1944 (WELT); Mt. St. Col, W. B. BROCKIE, 1946 (WELT); Mt. Azimuth, W. B. BROCKIE, 1947 (WELT); J. H. SORENSSEN, 1947 (WELT). — South Isl.: Castle Hill, Canterbury, I. KIRK no. 546 (WELT); Otago, PETRIE (WELT); Central Otago, W. PETRIE (WELT); W. coast SW. of Nelson, TOWNSON (WELT); Mt. Richmond, A. MORRIS JONES (WELT); Lake Ohau, L. H. GORGE (WELT); Mt. Torlesse, S. BERGGREN, 1874 (LD, S, GB); Killys Rg., S. BERGGREN, 1874 (LD, S); Otira alp., S. BERGGREN, 1874 (LD); Mt. St. Bathans, Otago, PETRIE, 1889 (WELT); L. Lyndon, I. KIRK, 1891 (WELT); Nelson distr., J. G. GIBBS, 1905 (WELT); Mt. Cook, GIBBS no. 1875, 1908 (BM); Mt. Clengheavn, Fiord co., J. CROSBY SMITH, 1914 (WELT); Mt. M., Upper Routeburn Val., Fiord Distr., G. E. & G. DU RIETZ no. 1934, 1927 (S); Upper Routeburn Harris Saddle, G. E. & G. DU RIETZ no. 1752: 4, 1927 (S); Homer-Hollyford Confluence, W. R. B. OLIVER, 1944 (WELT); Stillwater River, Caswell Sound, Fiord Distr., W. R. B. OLIVER, 1949 (WELT); Fog Peak, Torlesse Rg., Canterbury, M. B. ASHWIN no. 793, 1959

(SMU). — North Isl.: Ruapehu, Waimaoino, W. PETRIE (WELT); Ruapehu, W. PETRIE (WELT); Mt. Egmont, 6000', J. BUCHANAN (v. *biflora* Buch.) (K); Ruapehu, H. HILL no. 549, 1890 (WELT); Ruahine Mts., A. OLSEN, 1894 (WELT); Mt. Egmont, B. C. ASTON, 1901 (WELT); Mt. Holdsworth, Tararua Ra., W. PETRIE, 1908 (WELT); Mt. Hector, Tararua, 1909 (WELT); Mt. Ruapehu, W. R. B. OLIVER, 1927 (WELT); Mt. Egmont, E. side, 4500', W. R. B. OLIVER, 1931 (WELT); Mt. Egmont, E. side, 5500', W. R. B. OLIVER, 1931 (WELT); Mt. Hector, Tararua, E. M. HEINE, 1932 (WELT); Mt. Egmont, E. M. HEINE, 1932 (WELT); Mt. Egmont, NE. side, E. M. HEINE, 1932 (WELT); Wanaka, Cadrona Riv. near Ballantyne's Bridge, G. SIMPSON, 1946 (v. *sessiliflora* Simpson) (CHR); Mt. Egmont, Kahni track near Bell Falls, B. G. HAMLIN no. 428, 1955 (WELT); Mt. Egmont, above Tahurangi, B. G. HAMLIN no. 432, 1955 (WELT).

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## Thunberg's South African Species of *Gladiolus*— Four Name Changes

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An account of the South African *Iridaceae* of THUNBERG's Herbarium published by the late Dr. N. E. BROWN in 1928 (Journ. Linn. Soc. 48: 15—55) contains a vast amount of information invaluable to anyone engaged in taxonomic work on the South African members of this family. In 1949 I had the privilege of spending two weeks examining these specimens in Uppsala, and revisited Uppsala in 1965 to make a further brief examination of the South African species of *Gladiolus* collected by THUNBERG.

As a result of my recent study of these and other important collections of the genus in Kew and various herbaria in Europe I find that in order to comply with the International Rules several changes in the nomenclature of the South African species of *Gladiolus* will have to be made. Four which concern THUNBERG's species are recorded here, with a few remarks about the species.

1. *G. bullatus* Thunb. ex N. E. Br. Journ. Linn. Soc. 48: 20. 1928; Index Kew. Suppl. 8: 101. 1930. *G. spathaceus* Pappe ex Baker Handbk. Irid. 208. 1892 et Fl. Cap. 6: 147. 1896; non L. f. 1781.

The type is sheet no. 1012 in THUNBERG's herbarium, on which N. E. BROWN commented in his paper: "*G. bullatus* Thunb. MS. in Herb. (not in Diss. Glad. 12 (1784) as quoted by Prof. Juel). One sheet. This is *G. SPATHACEUS* Pappe, not *G. inflatus* Thunb. as named by Klatt."

N. E. BROWN omitted to mention that PAPPE's name was illegitimate, being a later homonym of *G. spathaceus* L. f. (= *Babiana spathacea* (L. f.) Ker), published a little over a hundred years earlier, and therefore cannot be retained for the species. THUNBERG's manuscript name, which was associated with *G. spathaceus* Pappe by N. E. BROWN in 1928, should now be used for this species.

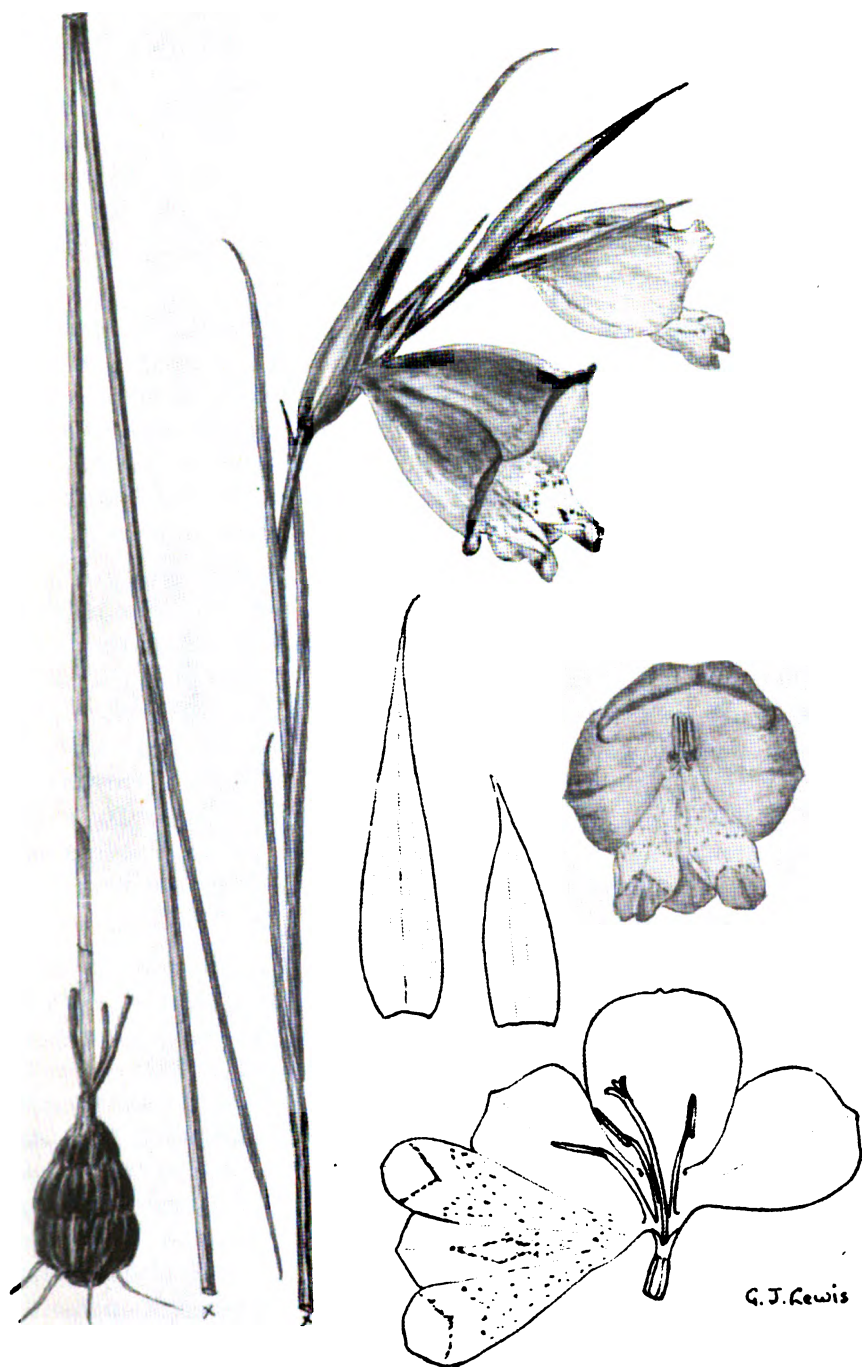


Fig. 1. *Gladiolus bullatus* Thunb. ex N. E. Br. Photograph of painting by G. J. LEWIS of LEWIS 6092 from Paardeberg Mts., Caledon—Bredasdorp districts.

2. *G. liliaceus* Hoult. Nat. Hist. II. 12: 55. t. 79. f. 2. 1780; PANZER Pflanzensyst. 11. 65. t. 79. f. 2. 1784. *G. versicolor* Andr. Bot. Rep. t. 19. 1798; KER in Bot. Mag. t. 1042. 1807 (var. *major*) et Gen. Irid. 135. 1827. *G. versicolor* var *major* Ker in Bot. Mag. sub t. 556. 1802. *G. tristis* L. var. *grandis* Thunb. Diss. Glad. no. 8 c. 1784. *G. grandis* Thunb. Prodr. 185. 1800, Fl. Cap. 1: 186. 1811 et ed. SCHULTES 45. 1823; KLATT Linnaea 32: 714. 1863; BAKER Handbk. Irid. 202. 1892 et Fl. Cap. 6: 138. 1896; N. E. BR. Journ. Linn. Soc. 48: 22. 1928; INGRAM Gard. Chron. Ser. 3. 88: 258—9 et 345. 1930.

It is unfortunate that this species, so aptly named *G. grandis* by THUNBERG in 1800 and so well known since then by that name, must revert to the older and little-known name given to it twenty years earlier by HOUTTUYN. However, even if HOUTTUYN's name was not legitimate, there is the name *G. versicolor* published by ANDREWS in 1798, with an excellent illustration of the plant, so that THUNBERG's is in fact the third to be given to this species and cannot be retained.

*G. liliaceus* was figured and described by HOUTTUYN, who noted that as it did not seem to belong to any of the named species he named it *G. liliaceus* because he considered that the flower looked very much like a lily, although it had the characteristics of *Gladiolus*, i. e. one of the lobes being shorter and broader than the others. His description, combined with the rather poor illustration, leaves no doubt as to the identity of the plant, but in addition there is a specimen of HOUTTUYN's named *G. liliaceus* in BURMANN's collection in the Delessert Herbarium in Geneva which agrees with the plant figured and is presumed to be the type. It is the only specimen of his with this name which I have seen.

In spite of this the identity of *G. liliaceus* appears to have remained obscure since the name was first published. It was placed with a query as a synonym of *G. angustus* L. by THUNBERG, and as a synonym of *G. gracilis* Jacq. by ROEMER & SCHULTES (Syst. Veg. 3: 392. 1827). KER placed it among the incertae in his Iridearum Genera and BAKER omitted the name altogether from this works on *Gladiolus*. MERRILL, in a paper on HOUTTUYN's New Genera and New Species published in 1938 (Journ. of Arnold Arboretum, v. 19, p. 326), referred to the species as follows: "*G. liliaceus* Hoult. Nat. Hist. . . . The entry in Index Kewensis is '*liliaceus* Hoult. Handleid. 12: 55=*angustus*, *gracilis*'. Houttuyn's figure does not conform to the published illustrations of either *G. angustus* L. or *G. gracilis* Jacq. Manifestly only a single species is represented, not

PLAAT LXXIX.

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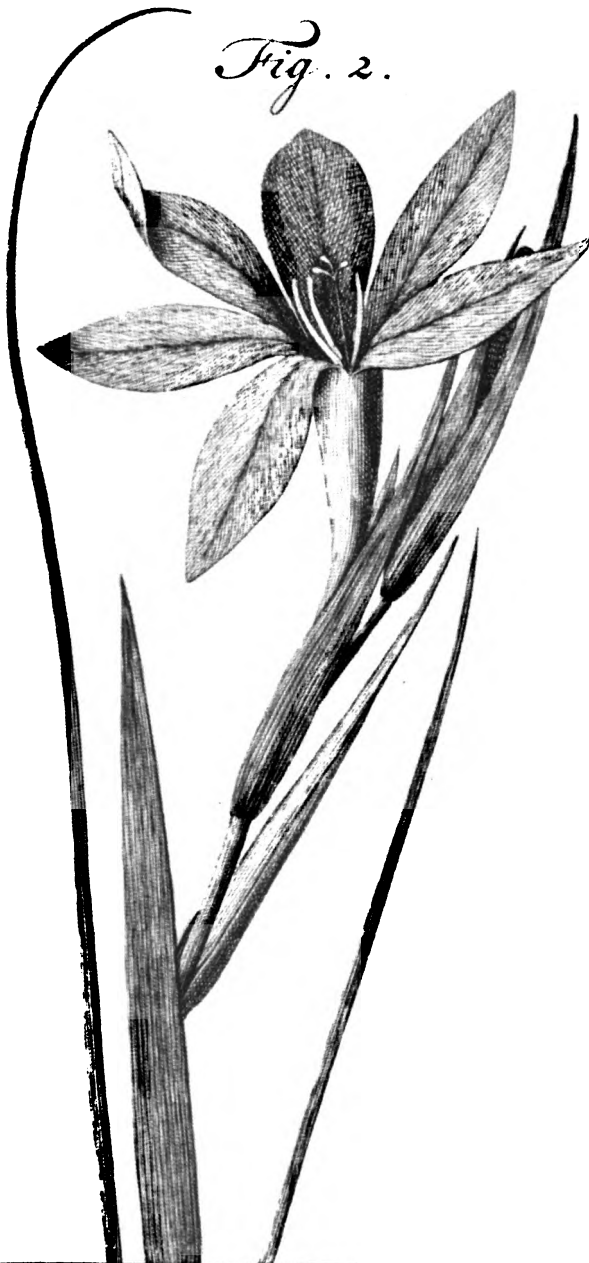


Fig. 2. *Gladiolus liliaceus* Houtt. Photograph of plant figured by HOUTTUYN in Nat. Hist. II, vol. 12.



Fig. 3. Photograph of *Gladiolus versicolor* Andr. Bot. Rep. t. 19 (= *G. liliaceus* Houtt.).

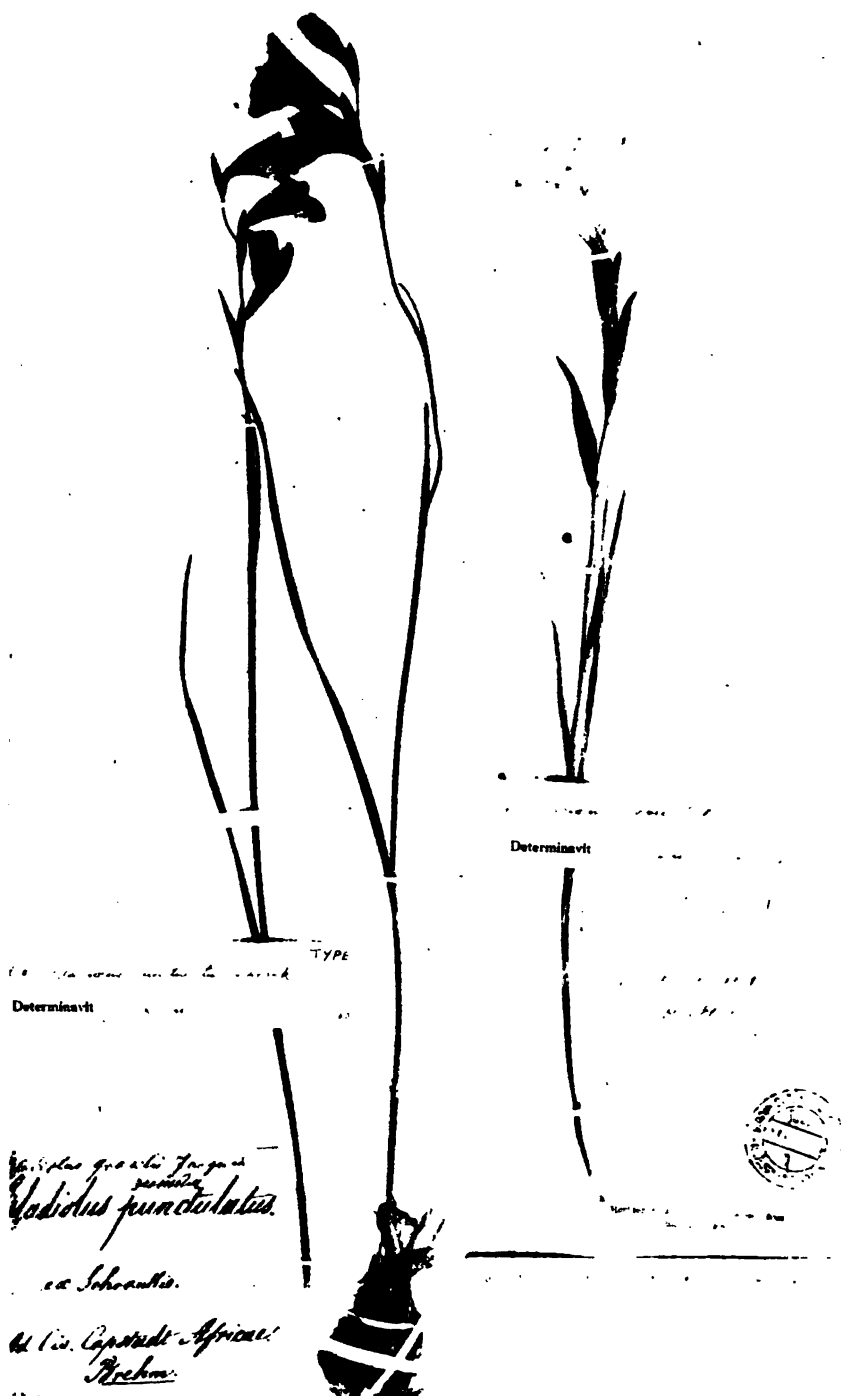
a mixture of two separate ones. It is not accounted for by Baker in his treatment of the Iridaceae of South Africa in the *Flora Capensis*, 6. Whilst it clearly belongs in the group with terete or slender leaves, I am not able, from my limited knowledge of the genus, to refer it definitely to any of the generally recognised species. Houttuyn's material was from the Cape of Good Hope."

HOUTTUYN described the flowers as yellow, which perhaps is a little misleading as a pure yellow flower is rare in this species. The yellow or dull ochre-yellow ground is almost always very densely covered with fine streaks, at least on part of the lobes, of either pale or dull brown, pinkish brown, pinkish red or purplish red, often with a deeper medial stripe on the upper lobes. Occasionally, however, it is partly streaked with a very pale brown or tawny colour so that the general effect is more yellow than brown. From the Knysna district eastwards the flowers are usually greenish cream in colour, often reddish in the throat and sometimes the lobes densely and closely speckled with red. The form from Port Elizabeth was described as *G. grandis* var. *lucidus* by INGRAM in 1930 (*Gard. Chron. Ser. 3*, 88: 345. f. 134).

*G. liliaceus* is closely allied to *G. tristis* L. and has often been confused with it, but is distinguished fairly readily by its much longer bract, usually tapering to a long pointed tip, and by its perianth lobes which usually taper to longer, more or less undulate recurved tips. In this respect HOUTTUYN's illustration is inaccurate. A specimen of *G. liliaceus* in the Linnaean Herbarium, sheet 59.8, is named *G. tristis* by the younger LINNAEUS, and in many of the old collections it has been recorded under that name. The type of *G. grandis* Thunb. is sheet no. 1031 in THUNBERG's Herbarium.

3. *G. punctulatus* Schrank Denks. Bot. Ges. Regensb. 2: 216. 1822. *G. tristis* var. 1 Thunb. Diss. Glad. 12. 1784. *G. laccatus* sensu THUNB. Prodr. 186. 1800 et Fl. Cap. ed. SCHULTES 45. 1823; N. E. BR. Journ. Linn. Soc. 48: 24. 1928; non JACQ. 1786—93. *G. hirsutus* var. *villosiusculus* Ker Bot. Mag. sub t. 727. 1804 et Bot. Mag. t. 823. 1805. *G. villosiusculus* Soland. ex Baker Journ. Linn. Soc. 16: 174. 1877, in syn. *G. biflorus* Roem. & Schult. Syst. 1: 416. 1817; non THUNB. 1784. *G. villosus* Ker Gen. Irid. 133. 1827 (excl. syn. *G. puniceus* et *G. lamarckii*); BAKER Handbk. Irid. 210. 1892 et Fl. Cap. 6: 149. 1896; LEWIS in ADAMSON & SALTER Fl. Cap. Pen. 258; non BURM. f. 1768. *G. pilosus* Eckl. Top. Verz. 38. 1827, *nomen nudum*; KLATT Linnaea 32: 709. 1863; LEWIS in ADAMSON & SALTER Fl. Cap. Pen. Append., 841, 1950.



Fig. 4. Type sheet of *Gladiolus punctulatus* Schrank.

Like many of the common species of *Gladiolus*, this one has undergone several name changes. THUNBERG first placed it as one of several varieties of *G. tristis* L. but in 1800, in his *Prodromus Plantarum Capensium*, he described the plants collected by himself under the name *G. laccatus*. In his account of the *Iridaceae* of THUNBERG's herbarium N. E. BROWN made the following comments on this: "One sheet (no. 1037), the type of *G. laccatus* Thunb., synonym *G. villosus* Ker (1827). Both Ker and Baker cite *G. puniceus* Lam. (1786) as a synonym of this, but from Lamarck's description, which does not mention any pubescence, it does not appear to be the same species. Should it prove to be so, Lamarck's name must take precedence." BROWN is not correct in ascribing the name *G. laccatus* to THUNBERG as THUNBERG himself cited *G. laccatus* Jacq. (1786—93), which is a misidentification as the plant figured and described by JACQUIN is a *Watsonia* (= *W. humilis* Mill.).

In 1805 the species was illustrated by KER in CURTIS' Botanical Magazine, t. 823, as a variety of *G. hirsutus* Jacq. (= *G. caryophyllaceus* (Burm. f.) Poir.). In the synonymy KER cited Breyn. Cent. 24. t. 12. f. 1, but BREYNIUS' figure, published in 1739, is not a good one and it is difficult to say with any certainty whether or not it represents this species. No hairs are shown on the leaves, nor are they mentioned in the description, although they are fairly conspicuous and can usually be seen without the aid of a lens. In 1827 KER raised the variety to specific rank, as *G. villosus*, and this name was upheld by BAKER in his Handbook of the Irideae and the Flora Capensis. Evidently both KER and BAKER overlooked the fact that the name had already been used by BURMANN F. in 1768 for another plant (now known as *Synnotia villosa* (Burm. f.) N. E. Br.).

*G. puniceus* Lam. (1786), renamed *G. lamarckii* by ROEMER & SCHULTES in 1817, was cited by KER as a synonym of *G. villosus*, but this is not correct. From LAMARCK's description and the specimen I have seen in his herbarium, his plant appears to be the pink colour form of *G. gracilis* Jacq.

In 1950, in an appendix to ADAMSON & SALTER's Flora of the Cape Peninsula, I stated that the name *G. villosus* Ker on page 258 should be substituted by *G. pilosus* Eckl. ex Klatt. However, having now examined the type of *G. punctulatus* Schrank I am able to confirm that it is the same species and as this name is older it takes precedence over ECKLON's.

On SCHRANK's type sheet in the Brussels herbarium there are three



Fig. 5. Sheet of *Gladiolus stellatus* Lewis in the Compton Herbarium.

specimens but the one on the right, marked f, which is added to the sheet, is *G. pappei* Baker. The label with the name *G. punctulatus* — collected near Cape Town by BREHM — obviously belongs to the specimens marked d and e which agree with SCHRANK's fairly detailed description.

4. *G. stellatus* Lewis nom. nov.

*G. tristis* var. e Thunb. Diss. Glad. 12. 1784. *G. elongatus* Thunb. Prodr. 185. 1800 et Fl. Cap. ed. SCHULTES 43. 1823; N. E. BR. Journ. Linn. Soc. 48: 21. 1928; non SALISB. 1796. *Geissorhiza patersoniae* L. Bol. Ann. Bol. Herb. 1: 32. 1915; FOSTER Contrib. Gray. Herb. no. 135. 71. 1941.

This slender and rather insignificant small-flowered species was first found nearly two hundred years ago by THUNBERG, who named it *G. elongatus*. In his paper on THUNBERG's herbarium N. E. BROWN stated that he could not find any specimen in Kew Herbarium to match THUNBERG's plant, and that THUNBERG's name must be retained for the species which evidently was nearly allied to *G. permeabilis*.

Unfortunately it is not possible to retain THUNBERG's name as the name was used by SALISBURY for another plant four years before it was published by THUNBERG (*G. elongatus* Salisb. 1796 = *Babiana tubulosa* (Burm. f.) Ker var. *tubiflora* (L. f.) Lewis). The same species was described by Dr. L. BOLUS as *Geissorhiza patersoniae* in 1915 but a species of *Gladiolus* was named after Mrs. PATERSON in 1928 so her name is not available for this one, and since a new name is required I have chosen to call it *G. stellatus* on account of the unusual star-like appearance of the flowers. Occasionally the dorsal lobe is slightly larger and raised a little above the other five but more often the lobes are more or less equal and the flowers actinomorphic or almost so.

The small regular flower, with its erect stamens symmetrically arranged round the style, and the thinness of the bracts, are characteristic of *Geissorhiza* rather than *Gladiolus*, and it was this resemblance which decided Dr. BOLUS to place the species in that genus when she described it as new, naming it after Mrs. F. PATERSON of Port Elizabeth who collected it in that area. Dr. BOLUS described the broadly winged seeds and remarked that the species showed some affinity to *Gladiolus*, but added that "living material exhibits the regular perianth and equilateral stamens characteristic of *Geissorhiza*."

Although regular flowers are rare in *Gladiolus* they do occur in two or three species and there is no doubt that this is another of the few exceptions. In some of my papers on the *Iridaceae* I have remarked

on the fact that the symmetry of the flower by itself is not always an entirely satisfactory generic character, and that the other organs of the plant must be taken into consideration as well. In the plant under discussion the corm, slender stem, leaves, bracts and broadly winged seeds bear no resemblance to those of any species of *Geissorrhiza*, whereas they are very similar to those of *Gladiolus permeabilis* De la R., and I agree with N. E. BROWN in regarding it as being nearly allied to that species. In the Flora Capensis BAKER placed *G. elongatus* Thunb. as a synonym of *G. gracilis* Jacq. but it has no affinity with that species.

The type is sheet 1020 in THUNBERG's herbarium in Uppsala, and in 1957 Prof. TYCHO NORLINDH noted on the sheet that "*Geissorrhiza patersoniae* L. Bol. seems to be identical with *Gladiolus elongatus* Th.".

### Summary

Changes are made in the nomenclature of 4 South African species of *Gladiolus* collected by THUNBERG.

1. The name *G. bullatus* Thunb. ex N. E. Br. should be used instead of the illegitimate name *G. spathaceus* Pappe ex Baker.
2. *G. liliaceus* Hoult., an earlier name to be reinstated for the species long known as *G. grandis* Thunb.
3. *G. punctulatus* Schrank. This name should be used for the common species variously known as *G. laccatus* sensu Thunb. (non Jacq.), *G. villosus* Ker (non Burm. f.) and *G. pilosus* Eckl. ex Klatt.
4. *G. stellatus* Lewis — a new name given to *G. elongatus* Thunb. (non Salisb.), and *Geissorrhiza patersoniae* L. Bolus.

## Floran i V. Torups och Finja socknar

### Ormbunkar och fröväxter

Av ALF OREDSSON

Botaniska museet, Lund

### Geografi

V. Torups och Finja socknar är belägna mellan Perstorp och Hässleholm i det inre av norra Skåne. Tillsammans har socknarna en areal av 126 km<sup>2</sup>, varav 71 km<sup>2</sup> tillhörande V. Torup och 55 km<sup>2</sup> Finja. Områdets enda större samhälle är Tyringe, beläget i västra delen av Finja socken. Landsvägen Hälsingborg—Hässleholm, som löper jämsides med järnvägen, delar området i en nordlig och en sydlig hälft.

Västra delen av Matterödsåsen, vilken når Tyringe i norr, är högre än 125 m, liksom delar av norra V. Torup och ett 10-tal smärre höjdyggar från södra V. Torup till norr om Tyringe. Större delen av östra Finja är beläget under 75 m ö. h. Fig. 1.

Morän är den vanligaste jordarten. Rullsten dominerar inom ett 8 km brett bälte i ostnordostlig riktning genom mellersta V. Torup. Sand förekommer huvudsakligen i socknarnas lägre delar samt kring Tyringe. I V. Torup finns åtskilliga torvmossar som är större än 0,1 km<sup>2</sup>. Torvmossar av denna storlek saknas i Finja. Fig. 2.

Områdets 7 större sjöar är belägna i södra hälften. Svenstorpssjön, Store damm, Fåglasjön, Håkantorps mölledamm och Håkantorps övre damm (96—104 m ö. h.) utgör ett sammanhängande system i sydvästra V. Torup. Grösjön (141 m) i samma socken ligger på Matterödsåsen. Till 1/4 belägen inom området är Finjasjön (43 m), vars yta, 11 km<sup>2</sup>, är dubbelt så stor som övriga sjöars tillsamman. Fig. 1.

Den del av Finja som ligger lägre än 75 m är slättbygd. I övrigt utgöres området av skogsbygd med småbruk.

### Artstatistik

Floran i området inventerades 1965. Totalt påträffades 675 arter, varav 560 i V. Torup och 619 i Finja. Tidigare har blott sporadiska växt-

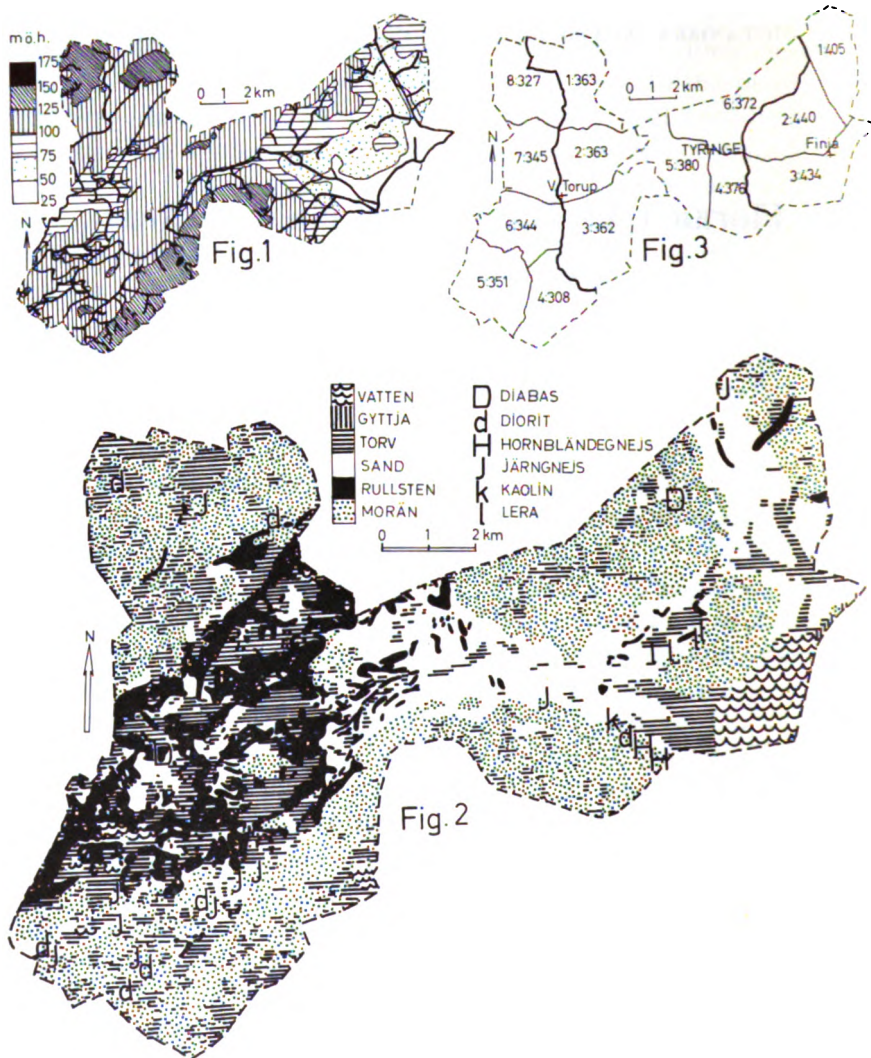


Fig. 1. Höjdförhållanden. Sjöar och vattendrag.

Fig. 2. Geologi (efter Sveriges geologiska undersökning 1871—77). Kaolinhaltiga jordarter uppges även för Hultet i V. Torup, Tyringe och Gunnarstorp i Finja (LUNDEGREN 1934).

Fig. 3. Sektionsindelning. Antal arter per sektion. Grov linje begränsar artfattigaste, resp. artrikaste område.

uppgifter förelegat. Emellertid har 14 arter förr iakttagna i Finja socken inte kunnat återfinnas (grupp 1).

V. Torup har delats i 8 sektioner och Finja i 6. Gränslinjerna utgöres av vägar. Artfattigast är de 5 västligaste sektionerna och atrikast de 3 östligaste. Skillnaden är omkring 90 arter per sektion. Fig. 3.

Arter, som är mindre vanliga eller har ojämn utbredning, har antecknats alltid. Till denna kategori hör 390 arter med tillsammans mer än 4000 lokaler. Återstoden, 285 arter, likaledes med över 4000 lokaler sammanlagt, har eftersökts i varje sektion men ej antecknats från varje fyndort. Koordinatsystemet UTM, som finns återgivet på Topografisk karta över Sverige, har gjort det möjligt att ange lokalerna med en noggrannhet av 100 m. Fältanteckningarna har överlämnats till Skånes Floras arkiv.

### Frekvensgradering

Alla påträffade arter med undantag för odlingsrester och arter som spritts från odling har frekvensgraderats. Således omfattar frekvensgraderingen 601 arter (grupperna 3—12).

% Frekvensbeteckning			Antal lokaler för alltid antecknad art	
13	sällsynt	s	1—2	
24	ganska sällsynt	gs	3—9	
16	ganska allmän	ga	10—35	
47	allmän	a	36—	Ej alltid antecknad art

### Väst-öst skala med poängberäkning

De grupper, vilkas arter med få undantag antecknats alltid, har graderats med avseende på lokalernas fördelning i väst-östlig riktning. Väst-öst skalan omfattar 350 arter (grupperna 6—12).

V Art antecknad endast i V. Torup

Vf på minst dubbelt fler lokaler i V. Torup än i Finja

vf i båda socknarna men ej på dubbelt fler lokaler i någondera

vF på minst dubbelt fler lokaler i Finja än i V. Torup

F endast i Finja

Inom var och en av de väst-öst graderade grupperna har en poängberäkning företagits. Varje art har poängsatts enligt dess frekvens, så att s, gs, ga och a motsvaras av 1, 2, 3, resp. 4 poäng. Talen har adderats inom varje väst-öst grad. Därigenom har en serie på 5 tal erhållits, motsvarande V-Vf-vf-vF-F i väst-öst skalan, för var och en av grupperna 6—12.

### Gruppindelning

Gruppindelningen omfattar samtliga arter antecknade 1965 eller tidigare, inalles 689 arter.



N:r	Innehåll	Antal arter
1	Arter som inte kunnat återfinnas .....	14
2	Odlingsrester och arter som spritts från odling .....	74
3	Ej alltid antecknade arter som påträffats i samtliga sektioner	180
4	Ej alltid antecknade arter som påträffats i 11—13 sektioner ....	43
5	Ej alltid antecknade arter som påträffats i 10 eller färre sektioner	28
6	Alltid antecknade arter som inte kunnat föras till någon av de följande grupperna .....	58
7	Kulturbetingade arter .....	89
8	Arter som växer torrt .....	65
9	Arter som växer fattigt .....	36
10	Arter som växer i ängsskog .....	32
11	Arter som växer i rikkärr .....	39
12	Arter som växer i sjöar och åar .....	31

### Grupp 1. Arter som inte kunnat återfinnas

Skånes Floras arkiv upptar 14 arter från Finja socken, vilka inte kunnat återfinnas inom området.

<i>Lycopodium tristachyum</i>	<i>Anemone vernalis</i>	<i>Apium inundatum</i>
<i>Eleocharis pauciflora</i>	<i>Neslia paniculata</i>	<i>Gentianella campestris</i>
<i>Leuchorchis albida</i>	<i>Bunias orientalis</i>	<i>Lamium hybridum</i>
<i>Stellaria nemorum</i>	<i>Rubus polyanthemus</i>	<i>Utricularia neglecta</i>
ssp. <i>glochidosperma</i>	<i>Rhamnus cathartica</i>	<i>Telekia speciosa</i>

### Grupp 2. Odlingsrester och arter som spritts från odling

Av arter, som är odlingsrester eller troligen har spritts från odling, har antecknats 74 arter, varav 59 i V. Torup och 64 i Finja.

<i>Picea abies</i>	<i>Aquilegia vulgaris</i>	<i>Medicago sativa</i>
<i>Acorus calamus</i>	<i>Papaver rhoeas</i>	<i>Euphorbia cyparissias</i>
<i>Narcissus pseudonarcissus</i>	<i>Brassica napus</i>	<i>Acer platanoides</i>
<i>Festuca trachyphylla</i>	<i>Ribes uva-crispa</i>	— <i>pseudoplatanus</i>
<i>Lolium multiflorum</i>	— <i>nigrum</i>	<i>Impatiens glandulifera</i>
<i>Cynosurus cristatus</i>	— <i>rubrum</i>	<i>Malva moschata</i>
<i>Agrostis gigantea</i>	— <i>alpinum</i>	<i>Viola odorata</i>
<i>Alopecurus pratensis</i>	<i>Spiraea salicifolia</i>	<i>Daphne mezereum</i>
<i>Bromus arvensis</i>	<i>Prunus avium</i>	<i>Cornus alba</i>
<i>Salix purpurea</i>	<i>Rosa rugosa</i>	<i>Hedera helix</i>
— <i>alba</i>	<i>Amelanchier spicata</i>	<i>Myrrhis odorata</i>
<i>Ulmus glabra</i>	<i>Pyrus communis</i>	<i>Carum carvi</i>
<i>Humulus lupulus</i>	<i>Sorbus intermedia</i>	<i>Aegopodium podagraria</i>
<i>Polygonum cuspidatum</i>	<i>Malus sylvestris</i>	<i>Heracleum mantegazzia-</i>
<i>Chenopodium bonus-</i>	<i>Crataegus calycina</i>	num
henricus	— <i>monogyna</i>	<i>Lysimachia nummularia</i>
<i>Saponaria officinalis</i>	<i>Cytisus scoparius</i>	<i>Vinca minor</i>

<i>Fraxinus excelsior</i>	<i>Digitalis purpurea</i>	<i>Solidago canadensis</i>
<i>Calystegia sepium</i>	<i>Galium odoratum</i>	<i>Chrysanthemum parthenium</i>
— <i>sylvestris</i>	<i>Sambucus nigra</i>	— <i>segetum</i>
<i>Polemonium caeruleum</i>	— <i>racemosa</i>	<i>Artemisia absinthium</i>
<i>Symphytum asperum</i>	<i>Lonicera periclymenum</i>	<i>Petasites hybridus</i>
<i>Myosotis sylvatica</i>	<i>Symphoricarpos rivularis</i>	<i>Echinops sphaerocephalus</i>
<i>Leonurus cardiaca</i>	<i>Campanula glomerata</i>	<i>Hieracium aurantiacum</i>
<i>Ballota nigra</i>	— <i>rapunculoides</i>	
<i>Mentha gentilis</i>	<i>Bellis perennis</i>	

### Grupp 3. Ej alltid antecknade arter som påträffats i samtliga sektioner

Med undantag för *Jasione montana* (grupp 8) ingår samtliga arter, som ej alltid antecknats och som påträffats i alla 14 sektionerna, i denna grupp. Frekvensbeteckning: allmän. Gruppen omfattar 180 arter. 95 procent av dem har betecknats som allmänna även i Norra Sandby socken (belägen omkring 10 km ONO Hässleholm), medan resterande 5 procent betecknats som ganska allmänna (OREDSSON 1961).

<i>Equisetum fluviatile</i>	<i>Poa pratensis</i>	<i>Alnus glutinosa</i>
<i>Pteridium aquilinum</i>	<i>Dactylis glomerata</i>	<i>Fagus sylvatica</i>
<i>Athyrium filix-femina</i>	<i>Deschampsia caespitosa</i>	<i>Quercus robur</i>
<i>Phegopteris polypodioides</i>	— <i>flexuosa</i>	<i>Urtica urens</i>
<i>Dryopteris filix-mas</i>	<i>Holcus lanatus</i>	— <i>dioica</i>
— <i>spinulosa</i>	— <i>mollis</i>	<i>Rumex tenuifolius</i>
— <i>austriaca</i>	<i>Agrostis stolonifera</i>	— <i>acetosella</i>
<i>Polypodium vulgare</i>	— <i>tenuis</i>	— <i>acetosa</i>
<i>Pinus sylvestris</i>	— <i>canina</i> ssp. <i>canina</i>	— <i>longifolius</i>
<i>Juniperus communis</i>	<i>Alopecurus geniculatus</i>	<i>Polygonum arenastrum</i>
<i>Alisma plantago-aquatica</i>	<i>Phleum pratense</i>	ssp. <i>arenastrum</i>
<i>Maianthemum bifolium</i>	<i>Anthoxanthum odoratum</i>	<i>Polygonum persicaria</i>
<i>Convallaria majalis</i>	<i>Agropyron repens</i>	— <i>lapathifolium</i>
<i>Juncus bufonius</i>	<i>Eriophorum vaginatum</i>	ssp. <i>lapathifolium</i>
— <i>bulbosus</i>	— <i>angustifolium</i>	— <i>lapathifolium</i>
— <i>articulatus</i>	<i>Carex canescens</i>	ssp. <i>pallidum</i>
— <i>effusus</i>	— <i>echinata</i>	— <i>hydropiper</i>
— <i>conglomeratus</i>	— <i>leporina</i>	— <i>convolvulus</i>
— <i>filiformis</i>	— <i>nigra</i>	<i>Chenopodium album</i>
<i>Luzula pilosa</i>	— <i>panicea</i>	<i>Atriplex patula</i>
— <i>campestris</i>	— <i>rostrata</i>	<i>Stellaria media</i>
<i>Sieglingia decumbens</i>	— <i>pilulifera</i>	— <i>alsine</i>
<i>Molinia caerulea</i>	<i>Populus tremula</i>	— <i>graminea</i>
<i>Glyceria fluitans</i>	<i>Salix aurita</i>	<i>Cerastium holosteoides</i>
<i>Festuca ovina</i>	— <i>caprea</i>	<i>Sagina procumbens</i>
— <i>rubra</i>	<i>Carpinus betulus</i>	<i>Spergula arvensis</i>
<i>Lolium perenne</i>	<i>Corylus avellana</i>	<i>Scleranthus annuus</i>
<i>Poa annua</i>	<i>Betula verrucosa</i>	<i>Caltha palustris</i>
— <i>trivialis</i>	— <i>pubescens</i>	<i>Ranunculus acris</i>

<i>Ranunculus repens</i>	<i>Epilobium montanum</i>	<i>Galium verum</i>
— <i>flammula</i>	— <i>palustre</i>	— <i>mollugo</i>
<i>Capsella bursa-pastoris</i>	<i>Chamaenerion angustifolium</i>	— <i>aparine</i>
<i>Sisymbrium officinale</i>		<i>Succisa pratensis</i>
<i>Filipendula ulmaria</i>	<i>Anthriscus sylvestris</i>	<i>Knautia arvensis</i>
<i>Prunus padus</i>	<i>Peucedanum palustre</i>	<i>Campanula rotundifolia</i>
<i>Rubus saxatilis</i>	<i>Vaccinium vitis-idaea</i>	<i>Solidago virgaurea</i>
— <i>idaeus</i>	— <i>uliginosum</i>	<i>Gnaphalium sylvaticum</i>
— <i>nessensis</i>	— <i>myrtilus</i>	<i>Bidens tripartita</i>
— <i>plicatus</i>	<i>Oxycoccus palustris</i>	<i>Anthemis arvensis</i>
<i>Fragaria vesca</i>	<i>Calluna vulgaris</i>	<i>Achillea ptarmica</i>
<i>Potentilla palustris</i>	<i>Empetrum nigrum</i>	— <i>millefolium</i>
— <i>erecta</i>	<i>Lysimachia vulgaris</i>	<i>Matricaria matricarioides</i>
— <i>anserina</i>	<i>Trientalis europaea</i>	<i>Artemisia vulgaris</i>
<i>Sorbus aucuparia</i>	<i>Myosotis arvensis</i>	<i>Tussilago farfara</i>
<i>Geum urbanum</i>	<i>Scutellaria galericulata</i>	<i>Senecio vulgaris</i>
<i>Trifolium hybridum</i>	<i>Glechoma hederacea</i>	— <i>sylvaticus</i>
— <i>repens</i>	<i>Prunella vulgaris</i>	<i>Arctium minus</i>
— <i>pratense</i>	<i>Galeopsis bifida</i>	<i>Cirsium vulgare</i>
<i>Lotus corniculatus</i>	— <i>tetrahit</i>	— <i>palustre</i>
<i>Vicia hirsuta</i>	<i>Lamium purpureum</i>	— <i>arvense</i>
— <i>cracca</i>	<i>Lycopus europaeus</i>	<i>Lapsana communis</i>
<i>Lathyrus montanus</i>	<i>Mentha arvensis</i>	<i>Leontodon autumnalis</i>
<i>Oxalis acetosella</i>	<i>Scrophularia nodosa</i>	<i>Scorzonera humilis</i>
<i>Geranium pusillum</i>	<i>Veronica serpyllifolia</i>	<i>Taraxacum Vulgaria</i>
<i>Erodium cicutarium</i>	— <i>arvensis</i>	<i>Sonchus arvensis</i>
<i>Rhamnus frangula</i>	— <i>chamaedrys</i>	— <i>asper</i>
<i>Hypericum maculatum</i>	— <i>officinale</i>	<i>Crepis tectorum</i>
<i>Drosera rotundifolia</i>	<i>Melampyrum pratense</i>	— <i>paludosa</i>
<i>Viola riviniana</i>	<i>Plantago major</i>	<i>Hieracium pilosella</i>
— <i>canina</i>	— <i>lanceolata</i>	— <i>vulgatum</i>
— <i>palustris</i>	<i>Galium palustre</i>	
— <i>arvensis</i>	— <i>saxatile</i>	

#### Grupp 4. Ej alltid antecknade arter som påträffats i 11-13 sektioner

Till denna grupp har förts 43 arter, som ej alltid antecknats och som påträffats i 11—13 sektioner. Fyra arter har förts till andra grupper, nämligen *Trifolium dubium* (grupp 7), *Teesdalia nudicaulis* (grupp 8), *Calla palustris* och *Rubus chamaemorus* (båda grupp 9). Frekvensbeteckning: allmän. 72 procent är allmänna även i Norra Sandby socken, medan 23 procent där har betecknats som ganska allmänna och 5 procent som ganska sällsynta.

<i>Equisetum arvense</i>	<i>Typha latifolia</i>	<i>Festuca pratensis</i>
— <i>sylvaticum</i>	<i>Lemna minor</i>	<i>Arrhenatherum elatius</i>
<i>Gymnocarpium dryopteris</i>	<i>Potamogeton natans</i>	<i>Phalaris arundinacea</i>

Bromus hordeaceus	Erophila verna	Galeopsis speciosa
Carex pallescens	Geum rivale	Stachys palustris
Salix repens	Trifolium medium	Valeriana dioica
— pentandra	Geranium robertianum	Gnaphalium uliginosum
Rumex crispus	Viola tricolor	Chrysanthemum leucanthemum
— obtusifolius	Epilobium obscurum	Tripleurospermum inodorum
Arenaria serpyllifolia	Pimpinella saxifraga	Arnica montana
Moehringia trinervia	Angelica sylvestris	Hypochoeris radicata
Anemone nemorosa	Naumburgia thyrsiflora	Hieracium laevigatum
Fumaria officinalis	Menyanthes trifoliata	— umbellatum
Raphanus raphanistrum	Myosotis palustris	
Thlaspi arvense	— caespitosa	

### Grupp 5. Ej alltid antecknade arter som påträffats i 10 eller färre sektioner

Gruppen består av 28 arter (27 i vardera socknen), som ej alltid antecknats och som påträffats i 10 eller färre sektioner. Sju arter har förts till andra grupper, nämligen *Chelidonium majus*, *Medicago lupulina*, *Anchusa arvensis* (grupp 7), *Sedum telephium* ssp. *telephium*, *Hypericum perforatum*, *Verbascum nigrum* och *Linaria vulgaris* (grupp 8). Frekvensbeteckning: allmän. 61 procent av gruppens arter är allmänna även i Norra Sandby socken, medan resterande 39 procent är ganska allmänna.

Luzula multiflora	Cardamine pratensis	Lythrum salicaria
Phragmites communis	— palustris	Ajuga pyramidalis
Nardus stricta	Barbarea vulgaris	Euphrasia brevipila
Calamagrostis epigeios	Arabis thaliana	— curta
— canescens	Prunus spinosa	Odontites verna
Polygonum aviculare	Alchemilla glabra	Rhinanthus minor
ssp. aviculare	Rosa villosa	Viburnum opulus
Cerastium arvense	Crataegus oxyacantha	Lactuca muralis
Nymphaea alba ssp. alba	Vicia angustifolia	Hieracium auricula
Nuphar lutea	Euphorbia helioscopia	

### Grupp 6. Alltid antecknade arter som inte kunnat föras till någon av de följande grupperna

Alltid antecknade arter, vilka förekommer på från grupperna 7—12 avvikande sätt, har sammanförts till denna grupp. Gruppen innehåller 58 arter. Frekvensgradering, väst-öst gradering och poängberäkning har företagits, liksom beträffande följande grupper. Resultat av poängberäkning för gruppen: 14-25-52-22-12. Fig. 4 visar utbredningen av

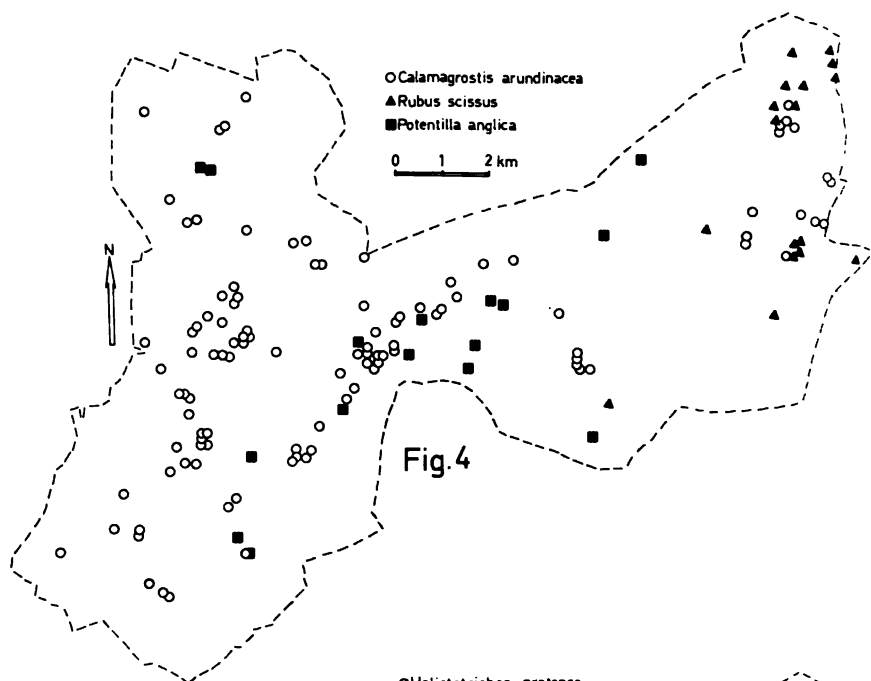


Fig. 4

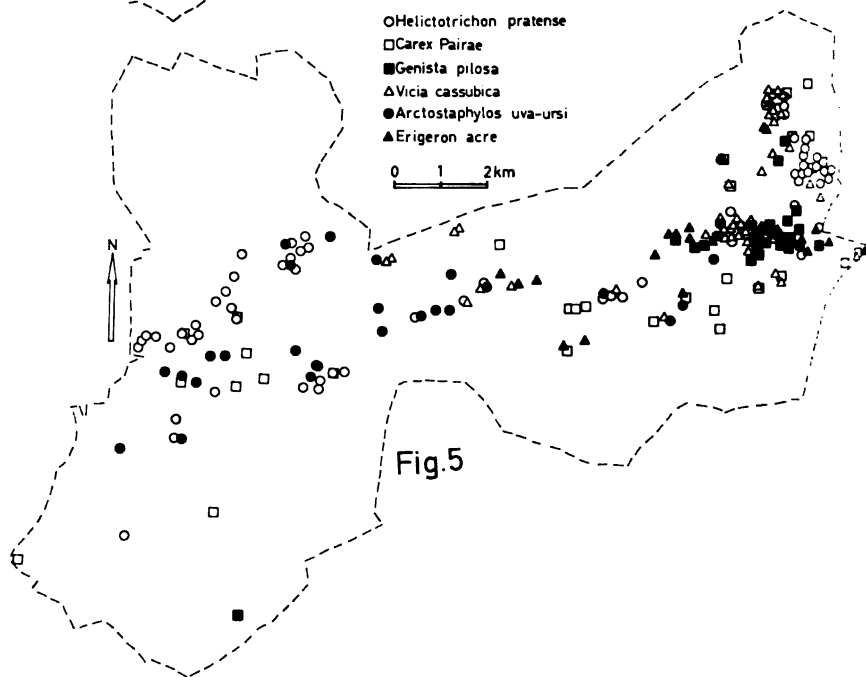


Fig. 5

Fig. 4. *Calamagrostis arundinacea* är spridd i V. Torup, men i Finja begränsad till rikare områden. *Rubus scissus* W. Wats. förekommer endast i östra Finja. *Potentilla anglica* har en svårtolkad utbredning.

Fig. 5. Några arter som växer torrt (grupp 8).

*Calamagrostis arundinacea*, *Rubus scissus* och *Potentilla anglica*.

<b>V</b>	<b>Vf</b>	<b>vf</b>
gs <i>Juncus compressus</i>	ga <i>Triglochin palustre</i>	a <i>Gagea lutea</i>
<i>Alopecurus aequalis</i>	a <i>Calamagrostis</i>	<i>Epilobium adenocaulon</i>
<i>Stellaria longifolia</i>	<i>arundinacea</i>	
<i>Rubus Lindebergii</i>		<b>vF</b>
<i>Alchemilla subcrenata</i>	<b>vf</b>	gs <i>Cardamine amara</i>
<i>Geranium sylvaticum</i>	s <i>Pyrola rotundifolia</i>	<i>Potentilla norvegica</i>
<i>Pyrola media</i>	gs <i>Sparganium minimum</i>	<i>Alchemilla acutiloba</i>
<i>Cuscuta europaea</i>	<i>Juncus tenuis</i>	<i>Callitriche palustris</i>
<i>Euphrasia glabrescens</i>	<i>Rosa dumalis</i>	<i>Ramischia secunda</i>
<i>Linnaea borealis</i>	<i>Polygala vulgaris</i>	ga <i>Lycopodium selago</i>
gs <i>Carex diandra</i>	<i>Callitriche stagnalis</i>	<i>Platanthera bifolia</i>
— <i>dioica</i>	<i>Veronica scutellata</i>	— <i>chlorantha</i>
	<i>Utricularia minor</i>	<i>Monotropa hypopitys</i>
<b>Vf</b>	<i>Taraxacum Obliqua</i>	
gs <i>Cystopteris fragilis</i>	ga <i>Sparganium simplex</i>	<b>F</b>
<i>Carex Oederi</i>	— <i>erectum</i>	s <i>Berberis vulgaris</i>
— <i>tumidicarpa</i>	<i>Glyceria declinata</i>	gs <i>Salix viminalis</i>
<i>Alchemilla glaucescens</i>	<i>Eleocharis palustris</i>	<i>Alchemilla pastoralis</i>
— <i>filicaulis</i>	<i>Quercus petraea</i>	<i>Callitriche polymorpha</i>
<i>Rosa canina</i>	<i>Potentilla anglica</i>	<i>Epilobium rubescens</i>
<i>Peplis portula</i>	<i>Pyrola minor</i>	ga <i>Rubus scissus</i> W. Wats.
<i>Pedicularis palustris</i>	<i>Galium uliginosum</i>	( <i>R. fissus</i> auct. mult.,
<i>Hieracium sylvaticum</i>	<i>Antennaria dioica</i>	non Lindley 1835)

**Grupp 7. Kulturbetingade arter**

Gruppen omfattar 89 arter, vilka förekommer på åkrar, vid hus, på vägrenar och utmed järnvägen. Rikast ruderatflora har landsvägen Hälsingborg—Hässelholm från Tyringe och österut. Resultat av poängberäkning för gruppen: 6-10-36-79-54.

<b>V</b>	<b>vf</b>	<b>vF</b>
gs <i>Avena fatua</i>	<i>Euphorbia peplus</i>	gs <i>Chenopodium</i>
<i>Vicia panonica</i> ssp.	<i>Lamium album</i>	<i>polyspermum</i>
<i>striata</i>	<i>Solanum nigrum</i>	<i>Cerastium glomeratum</i>
<i>Oxalis europaea</i>	<i>Galium Vaillantii</i>	<i>Melandrium album</i>
<i>Euphorbia esula</i>	<i>Matricaria recutita</i>	<i>Descurainia sophia</i>
gs <i>Malva sylvestris</i>	<i>Cardus crispus</i>	<i>Potentilla intermedia</i>
<b>Vf</b>	ga <i>Sinapis arvensis</i>	<i>Aethusa cynapium</i>
gs <i>Chenopodium rubrum</i>	<i>Erysimum</i>	<i>Echium vulgare</i>
<i>Lepidium campestre</i>	<i>cheiranthoides</i>	<i>Galeopsis ladanum</i>
<i>Rorippa sylvestris</i>	<i>Geranium molle</i>	<i>Lamium amplexicaule</i>
a <i>Chelidonium majus</i>	<i>Veronica agrestis</i>	<i>Chaenorrhinum minus</i>
<b>vf</b>	— <i>persica</i>	<i>Rhinanthus serotinus</i>
gs <i>Stachys arvensis</i>	<i>Galinsoga ciliata</i>	<i>Artemisia campestris</i>
gs <i>Geranium dissectum</i>	<i>Sonchus oleraceus</i>	<i>Senecio vernalis</i>

vF	F	F
Centaurea cyanus	s Chenopodium glaucum	Centaurea nigra
ga Spergularia rubra	Dianthus armeria	Hypochoeris glabra
Silene cucubalus	Brassica campestris	gs Setaria viridis
Sinapis alba	Lepidium densiflorum	Apera spica-venti
Trifolium campestre	Arabis arenosa	Bromus inermis
Anthyllis vulneraria	Potentilla reptans	Herniaria glabra
Torilis japonica	Aphanes microcarpa	Dianthus deltoides
Daucus carota	Medicago falcata	Berteroa incana
ssp. carota	Melilotus officinalis	Melilotus albus
Erigeron canadense	Impatiens parviflora	Trifolium aureum
Chrysanthemum	Malva neglecta	Vicia tetrasperma
vulgare	Chaerophyllum	Pastinaca sativa
Senecio viscosus	temulum	Anchusa officinalis
Arctium tomentosum	Heracleum	Anthemis tinctoria
Tragopogon pratensis	sphondylium	Tragopogon pratensis
ssp. minor	ssp. sibiricum	ssp. pratensis
Crepis capillaris	Convolvulus arvensis	ga Papaver dubium
a Medicago lupulina	Lithospermum arvensis	Camelina sativa
Trifolium dubium	Veronica opaca	ssp. microcarpa
Anchusa arvensis	Campanula patula	Oenothera biennis

### Grupp 8. Arter som växer torrt

Gruppen utgöres av 65 arter, som växer på hedar, torrängar och i bryn och som huvudsakligen förekommer inom ett bälte på rullsten och sand, vilket löper genom området i väst-östlig riktning. Rikligast är gruppen företrädd i östra Finja, dels mellan Svärtingstorp och Backagården och österut, dels mellan Gärastorp och Gunnarstorp. Resultat av poängberäkning för gruppen: 5-0-41-83-42. Fig. 5 (jmf. fig. 2).

V	vf	vF
s Cardamine hirsuta	Sedum telephium	Scleranthus perennis
gs Verbascum thapsus	ssp. telephium	Anemone pulsatilla
Valeriana officinalis	Potentilla argentea	Filipendula vulgaris
	Linaria vulgaris	Genista pilosa
vf		Trifolium arvense
s Helichrysum arenarium	vF	Veronica verna
gs Aira caryophylla	gs Lycopodium clavatum	Filago minima
Sedum acre	Botrychium lunaria	a Helictotrichon
ga Carex caryophylla	Thalictrum simplex	pubescens
Arctostaphylos uva-ursi	Ranunculus bulbosus	Rumex thyrsiflorus
Senecio jacobaea	Turritis glabra	Viscaria vulgaris
Hypochoeris maculata	ga Poa compressa	Teesdalia nudicaulis
a Helictotrichon pratense	Carex Pairae	Vicia cassubica
Carex montana	— hirta	Hypericum perforatum
— ericetorum	Cerastium	Thymus serpyllum
	semidecandrum	Verbascum nigrum

vF	F	F
Galium boreale	Primula veris	Rubus corylifolius
Jasione montana	Satureja vulgaris	Astragalus glycyphyllos
	Euphrasia m'crantha	Mysotis hispida
F	Taraxacum	— discolor
s Equisetum hyemale	Erythrosperma	Centaurea scabiosa
Botrychium	gs Polygonatum odoratum	ga Rubus caesius
matricariifolium	Aira praecox	Geranium sanguineum
Saxifraga granulata	Agrostis canina	Myosotis stricta
Genista germanica	ssp. montana	Campanula persicifolia
Vicia lathyroides	Polygonum dumetorum	Erigeron acre

### Grupp 9. Arter som växer fattigt

Gruppen består av 36 arter, vilka huvudsakligen förekommer på torvmossar eller i fattigkärr. Nordöstra delen av V. Torup (Strandböke-Hissmossa-St. Torsjö) har flest arter tillhörande denna kategori. Resultat av poängberäkning för gruppen: 17-36-25-9-1. Fig. 6 (jmf. fig. 9).

V	Vf	vf
s Lycopodium inundatum	Trichophorum	Juncus squarrosus
Blechnum spicant	caespitosum	ga Myrica gale
Rhynchospora fusca	ssp. caespitosum	Hydrocotyle vulgaris
Radiola linoides	Carex magellanica	Pedicularis sylvatica
gs Narthecium ossifragum	ga Rhynchospora alba	a Lycopodium annotinum
Eriophorum gracile	Carex limosa	Erica tetralix
Carex pauciflora	Dactylorhiza maculata	
— lasiocarpa	Drosera intermedia	vF
Sagina subulata	Andromeda polifolia	gs Dryopteris cristata
ga Trichophorum	Utricularia intermedia	Callitriche hamulata
caespitosum	a Calla palustris	Myriophyllum
ssp. caespitosum	Rubus chamaemorus	alterniflorum
		ga Chamaepericlymenum
	vf	suecicum
Vf	gs Sparganium	
gs Potamogeton alpinus	glomeratum	F
Poa supina	ga Potamogeton	s Scheuchzeria palustris
Eleocharis mamillata	polygonifolius	

### Grupp 10. Arter som växer i ängsskog

Till gruppen har förts 32 arter karakteristiska för ängsskogsvegetationen i området. De artrikaste ängsskogarna finns i södra V. Torup (vid Attarp, kring Lillarp och mellan Smedeboda och Gravaröd), väster om Tyinge och sydost om Tyinge. Resultat av poängberäkning för gruppen: 7-10-29-10-14. Fig. 7.



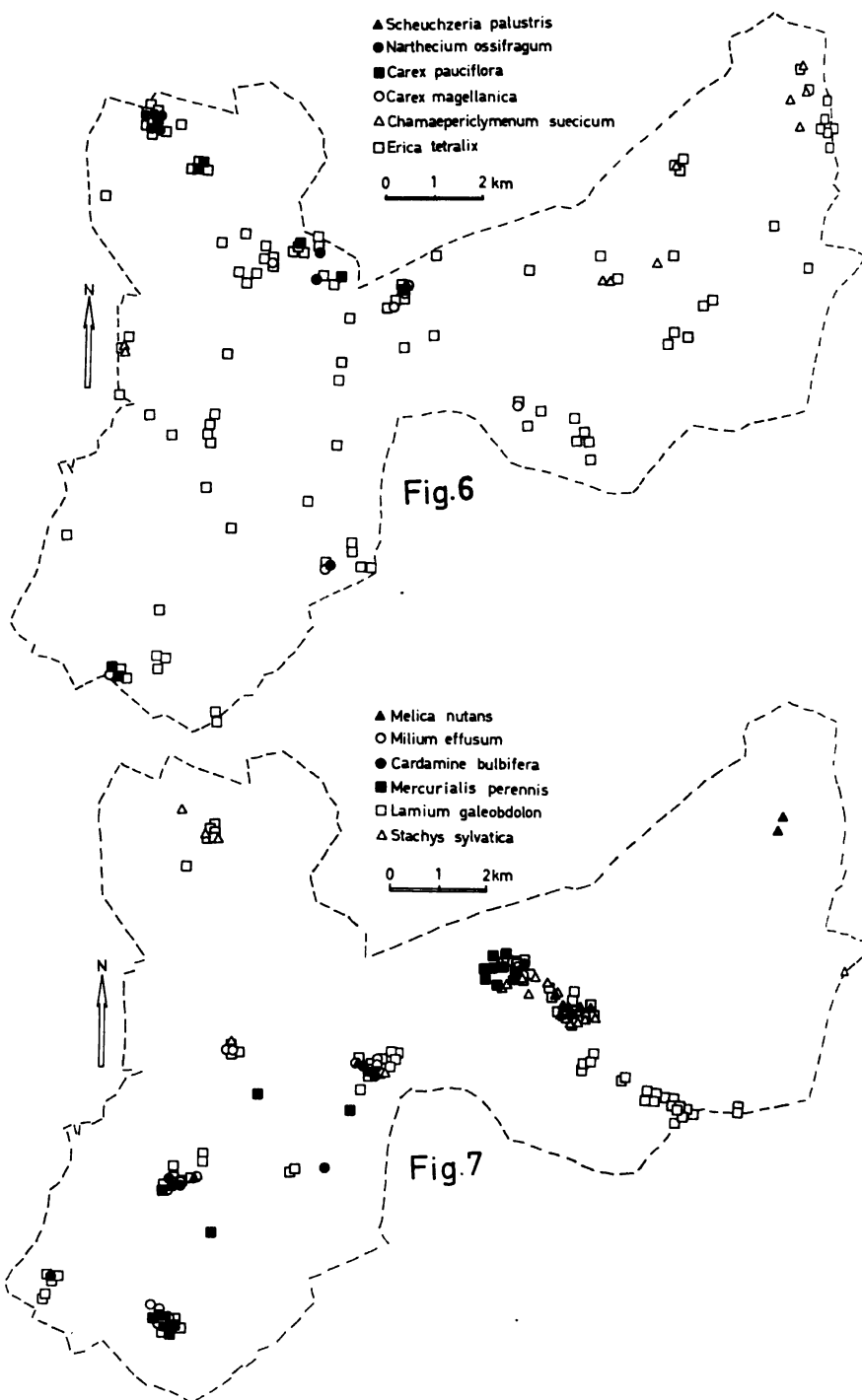


Fig. 6. Några arter som växer fattigt (grupp 9).

Fig. 7. Några arter som växer i ängsskog (grupp 10).

V	vf	vF
s <i>Lathyrus vernus</i>	gs <i>Melica uniflora</i>	ga <i>Melica nutans</i>
<i>Circaea intermedia</i>	ga <i>Equisetum pratense</i>	<i>Stachys sylvatica</i>
<i>Lonicera xylosteum</i>	<i>Anemone hepatica</i>	F
gs <i>Polygonatum</i>	<i>Mercurialis perennis</i>	s <i>Melandrium rubrum</i>
<i>multiflorum</i>	<i>Tilia cordata</i>	<i>Anemone ranunculoides</i>
<i>Cardamine flexuosa</i>	<i>Melampyrum</i>	<i>Vicia sepium</i>
	<i>sylvaticum</i>	<i>Lathraea squamaria</i>
Vf	a <i>Poa nemoralis</i>	<i>Adoxa moschatellina</i>
gs <i>Cardamine bulbifera</i>	<i>Ranunculus ficaria</i>	<i>Campanula trachelium</i>
<i>Pulmonaria officinalis</i>	<i>Lamium galeobdolon</i>	gs <i>Paris quadrifolia</i>
ssp. <i>obscura</i>	vF	<i>Festuca gigantea</i>
ga <i>Milium effusum</i>	gs <i>Polygonatum</i>	<i>Euonymus europaeus</i>
<i>Carex digitata</i>	<i>verticillatum</i>	<i>Impatiens noli-tangere</i>
	<i>Corydalis fabacea</i>	

### Grupp 11. Arter som växer i rikkärr

Till gruppen hör 39 arter, som växer i rikkärr och på ängar i anslutning till rikkärr. Rikkärren är bäst utbildade nedanför Matterödsåsen (St. Tockarp-Tyringe-Mjölkalånga), vid Strandböke och Attarp (i norra, resp. södra V. Torup), mellan Svärtingstorp och Backagården och österut samt kring Hörlingeån (i östra Finja). Resultat av poängberäkning för gruppen: 6-15-15-36-17. Fig. 8 (jmf. fig. 1).

V	vf	vF
s <i>Glyceria plicata</i>	<i>Trollius europaeus</i>	<i>Rorippa islandica</i>
<i>Dactylorhiza incarnata</i>	ga <i>Carex elongata</i>	<i>Lathyrus pratensis</i>
gs <i>Carex disticha</i>	<i>Lychnis flos-cuculi</i>	<i>Veronica beccabunga</i>
— <i>hostiana</i>	<i>Chrysosplenium</i>	a <i>Scirpus silvaticus</i>
	<i>alternifolium</i>	<i>Valeriana sambucifolia</i>
Vf	vF	F
gs <i>Carex pulicaris</i>	gs <i>Poa palustris</i>	s <i>Montia rivularis</i>
— <i>remota</i>	<i>Salix cinerea</i>	<i>Epilobium hirsutum</i>
<i>Ranunculus sceleratus</i>	— <i>fragilis</i>	— <i>parviflorum</i>
<i>Circaea alpina</i>	<i>Solanum dulcamara</i>	gs <i>Carex acutiformis</i>
<i>Bidens cernua</i>	<i>Cirsium heterophyllum</i>	<i>Stellaria palustris</i>
<i>Leontodon hispidus</i>	ga <i>Carex vesicaria</i>	<i>Selinum carvifolia</i>
ga <i>Briza media</i>	<i>Thalictrum</i>	<i>Cirsium oleraceum</i>
vf	<i>aquilegiifolium</i>	ga <i>Lotus pedunculatus</i>
gs <i>Equisetum palustre</i>	ga <i>Ranunculus auricomus</i>	<i>Epilobium roseum</i>
<i>Montia fontana</i>		

### Grupp 12. Arter som växer i sjöar och åar

Gruppen omfattar 31 arter, vilka huvudsakligen förekommer i sjöarna i sydvästra V. Torup, Finjasjön och Almaån. Enligt WEIMARCK (1963)

föredrar  $\frac{2}{3}$  av dessa arter näringsrika vatten, medan endast 1 art (*Littorella uniflora*) helst växer i urbergssjöar. Resultat av poängberäkning för gruppen: 8-8-9-9-20. Fig. 1.

V	vf	F
s <i>Typha angustifolia</i>	ga <i>Schoenoplectus</i>	<i>Eleocharis acicularis</i>
<i>Myriophyllum</i>	<i>lacustris</i>	<i>Rumex hydrolapathum</i>
<i>verticillatum</i>	<i>Carex acuta</i>	<i>Thalictrum flavum</i>
<i>Eupatorium</i>	<i>Polygonum amphibium</i>	<i>Sium latifolium</i>
<i>cannabinum</i>		<i>Mentha aquatica</i>
gs <i>Potamogeton</i>	vf	<i>Utricularia vulgaris</i>
<i>obtusifolius</i>	gs <i>Potamogeton crispus</i>	<i>Littorella uniflora</i>
ga <i>Carex elata</i>	<i>Ranunculus peltatus</i>	gs <i>Potamogeton pusillus</i>
	<i>Cicuta virosa</i>	— <i>perfoliatus</i>
Vf	ga <i>Iris pseudacorus</i>	<i>Barbarea stricta</i>
gs <i>Hydrocharis</i>		<i>Rorippa amphibia</i>
<i>morsus-ranae</i>	F	<i>Callitriche</i>
<i>Glyceria maxima</i>	s <i>Najas flexilis</i>	<i>hermaphrodita</i>
<i>Oenanthe aquatica</i>	<i>Potamogeton gramineus</i>	
<i>Hottonia palustris</i>	s <i>Butomus umbellatus</i>	

### Översikt

Floran är fattig inom 3 höjdparter på morän, nämligen Matterödsåsen, området nordost om Tyringe samt nordöstligaste hörnet av Finja socken. I övrigt är Finja huvudsakligen rikt. V. Torup är mera uppsplittat, med den nordligaste delen som något fattigare. Fig. 9.

Endast den grupp av arter som växer fattigt (9) är mest representerad i V. Torup. Sammelgruppen (6) och ängsskogsarter (10) är båda jämnt fördelade mellan socknarna. Rikkärrarterna (11) visar ett överskott i Finja. Arter som växer torrt (8) eller är kulturbetingade (7) förekommer huvudsakligen i Finja. Arter som växer i sjöar och åar (12) utgör den enda grupp som domineras av arter vilka endast förekommer i en av socknarna (Finja). Fig. 10.

### Summary

#### Vascular Plants in the Parishes of V. Torup and Finja

The parishes of V. Torup and Finja are situated in the inner part of north Scania. The district is dominated by forest, except in the lower part of Finja, which is an agricultural area. An investigation in 1965 of the flora has revealed 675 species of vascular plants. Twelve groups of species have been established: (1) earlier reported from Finja but not refound, (2) earlier cultivated or spread from culture, (3—5) common and not always noted, (6) always noted but not to be put into any of the following groups, (7) bound to culture: preferring (8) dry ground, (9) poor areas, (10) meadow forests, (11) rich-fens, (12) lakes or streamlets. The species in group 3—12 are divided into 4 grades

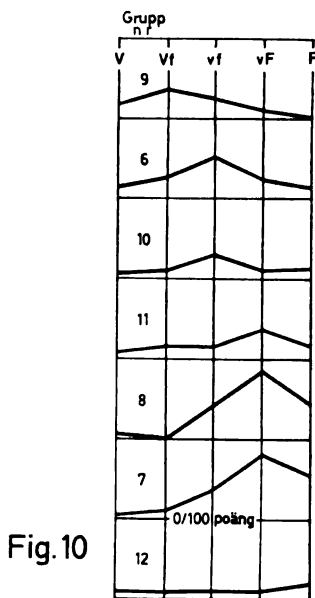
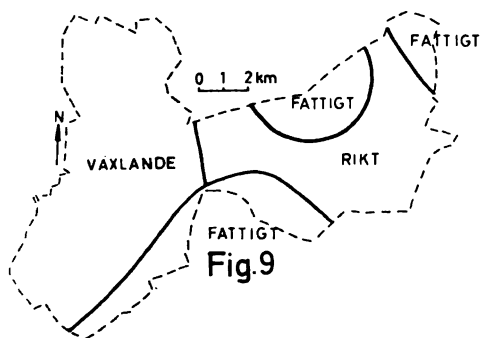
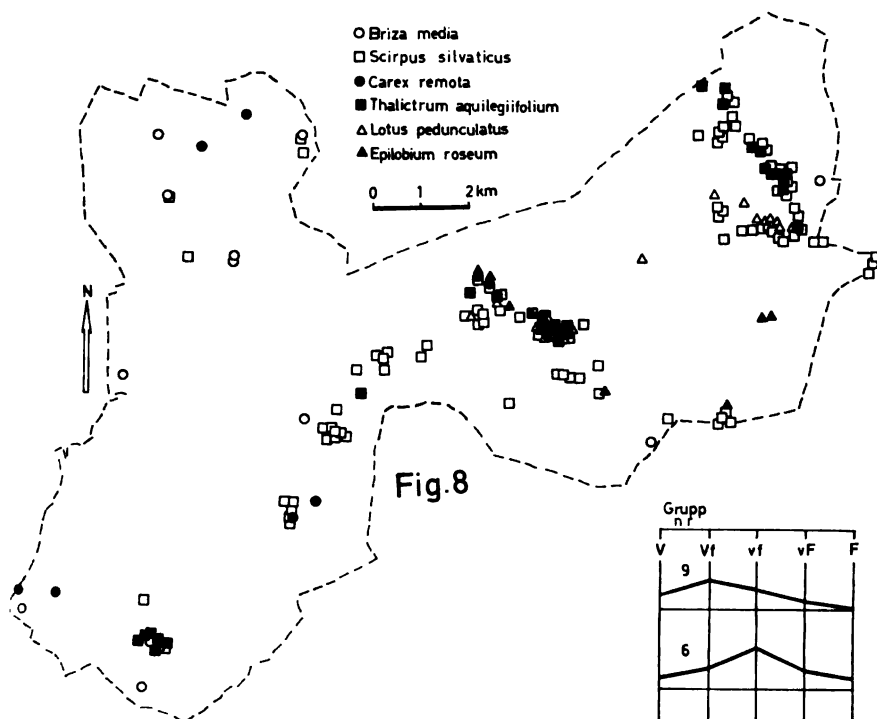


Fig. 8. Några arter som växer i rikkärr (grupp 11).

Fig. 9. Schematisk indelning av området med avseende på floran.

Fig. 10. Väst-öst skala med resultat av poängberäkning för grupperna 6-12.

of frequency: (s) rare, (gs) rather rare, (ga) rather common, (a) common. The species in group 6-12 are divided into 5 blocks with regard to their occurrence from west to east: (V) noticed only in V. Torup, (Vf) noticed twice as often or more in V. Torup, (vf) a middle group, (vF) noticed twice as

often or more in Finja, (F) noticed only in Finja. Frequency points have been added in each block (one rare species stands for 1, one rather rare species stands for 2, a. s. o.). Species occurring in poor areas have most often been found in the west, while the species bound to culture and the species that prefer dry ground dominate in the east. Three higher parts on moraine are mainly poor. Except these, the eastern part of the district is rich, while the western one is varying (fig. 9).

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## New Species of *Arenaria* and *Draba* from Alaska and Yukon

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During botanical investigations in Alaska and Yukon the writer has collected a number of interesting taxa, some of which have proved to be undescribed. Among them are an *Arenaria*, closely related to the especially among Scandinavian botanists much discussed *A. humifusa* Wahlenb. which it replaces in the western American mountains, and a large and beautiful yellowflowered *Draba*, related to the interesting *Draba sibirica* (Pall.) Thell. occurring in Siberia, with isolated localities in eastern Greenland.

They are described and illustrated below.

### *Arenaria longipedunculata* sp. nov.

*Arenaria humifusa* as to western American plant.

Stolones subterraneos pallidos formans; folia basalia lanceolata vel ovato-lanceolata, obtusa vel acutiuscula, glabra vel basin versus sparse ciliata; caules floriferi crassi, 1—2 cm longi, glanduloso-puberuli, semper uniflori; bracteae ovatae, acutae; sepala ovata, obtusa vel acutiuscula, indistincte trinervia, glabra vel glanduloso-puberula; petala alba, calyci aequilonga; capsula ovata calyci paullo longior; styli 3; semina circiter 0.7—0.8 mm longa, suborbiculata, rugulosa.

Type: Alaska: Umiat, July 23—29, 1960 E. HULTÉN (S).

Plant with pale subterranean runners; basal leaves lanceolate to ovate-lanceolate, obtuse or acutish, glabrous or sparsely ciliated at the base, flowering stems thick, 1—2 cm long, glandular puberulent; petals white, as long as the sepals; capsule ovate, slightly longer than the calyx; styles 3; seeds 0.7—0.8 mm long, suborbiculate, rugulose.

Differs from the related *Arenaria humifusa* in coarser growth, long



Fig. 1. *Arenaria longipedunculata* Hult. — Type specimen from Umiat, arctic Alaska.  
 $\times 1\frac{1}{2}$ .

peduncles and ovate, at the apex narrow, not cylindrical capsule, shorter in comparison to the sepals and slightly larger seeds. On account of the very different capsule the plant is not regarded as a subspecies of *A. humifusa*.



Fig. 2. *Draba ogilviensis* Hult. — Type specimen from Ogilvie Mountains, Yukon,  $\times 4/5$ .

Collected in several places in Alaska, Yukon and the Mackenzie Mts, as well as, in the Rocky Mts of British Columbia and Alberta.

*Draba ogilviensis* sp. nov.

*Draba sibirica* Pors in The Canad. Field Nat. 78: 2, 1964 p. 96, non Thell.

Solute caespitosa; caulis ramosus, rami longi, tenues, foliosi; folia elliptico-lanceolata, glabra vel pilis simplicibus paucis instructa, duo seu quattuor folia bina opposita vel omnia alterna iis caulium sterilium similia ferentes; pedicelli glabri, fructiferi divaricati; sepala ovata, trinervia, obtusa, glabra, margine



scariosa; petala 4—6 mm longa, aureola; siliquae oblongae, glabrae, reticulatae cum mucrone tenui 1 mm longo. — Solum ex montibus Ogilviae nota.

Type: Yukon: Ogilvie mountains, northeast of Dawson, N fork of Klondike R., Dempster Highway Mile 50, July 1964 E. HULTÉN (S).

Loosely matted, stem branched with long slender leafy branches; leaves glabrous or with very few simple or branched hairs in the margin, elliptic-lanceolate; flowering stem ascending, glabrous or with few simple hairs, with one to two pairs of opposite or alternating leaves, similar to those of the sterile shoots; pedicels glabrous, divaricate in fruit; sepals ovate, three-nerved, blunt, glabrous, scariousmargined; petals 4—6 mm long golden yellow; silicles oblong, glabrous, reticulated with a one mm long slender beak. — Only known from the Ogilvie Mts from about 1.200 m to 2.100 m in alpine meadows below snow flushes.

*Draba sibirica* was reported from Ogilvie Mts 120 miles northwest of Dawson collected by YOUNGMAN & TESSIER in a paper by PORSILD with the title "*Potentilla stipularis* L. and *Draba sibirica* (Pall.) Thell. new to North America". The report was accompanied by a drawing reproduced from O. GELERT in Bot. Tidsskr. 21: 3, 1898 fig. 9 of *Draba sibirica* and not by a drawing of the Yukon plant.

In 1964 the writer visited the Ogilvie Mts and collected abundant material of the plant reported by PORSILD as *D. sibirica* at Upper N Klondike R. and Blackstone R. east of that road.

The Yukon plant is abundantly different from *D. sibirica* by its large glabrous or slightly pubescent leaves, its large cauline leaves, its glabrous, distinctly three-nerved calyx, long, divaricate fruiting pedicels, and large silicles with longer slender style. *D. sibirica* is scapose. As the new *Draba* so far is known only from the Ogilvie mountains, where it was found to be common in several places, it may receive the name *Draba ogilviensis*.

## Murrutans (*Asplenium ruta-muraria* L.) förekomster i Göteborgs och Bohus län

AV SVANTE SUNESON

Tvårörsgatan 3, V. Frölunda

Vid min sedan lång tid tillbaka pågående inventering av kärlväxtfloran i Skaftö socken inom mellersta Bohusläns kustland hade jag under den gångna sommaren nöjet att finna en ny växtplats för murrutan (*Asplenium ruta-muraria* L.). Lokalen är belägen på Islandsberg, Skaftölandets bergiga utpost mot sydväst, närmare bestämt ca. 400 m N om Islandsbergs huvud i en hög, sydexponerad klippbrant strax innanför den nya fyren. Medan jag höll på att söka efter *Carex punctata*, som förekommer här på klipphyllor och vid foten av branter, upptäckte jag två små stånd av murrutan. De växte i en snedställd, smal springa i gnejsen på ett par meters höjd ovanför själva bergroten, något överskuggade av klippan. Vid ett senare besök på platsen upptäcktes en tredje liten tuva någon meter högre upp i samma spricka. Förgäves eftersöktes ytterligare förekomster i den omgivande, ganska svårtillgängliga klippterrängen. Vegetationen i klippspringan var sparsam och bestod förutom av murrutan av följande arter (räknat nedifrån bergroten): *Empetrum nigrum*, *Polygonatum odoratum*, *Holcus lanatus*, *Carex punctata*, *Eupatorium cannabinum*, *Lythrum salicaria*, *Hieracium umbellatum* (små ex.), *Sieglingia decumbens*, *Plantago maritima* och *Dryopteris spinulosa* (små ex.). Några blad av murrutan togs för pressning och ha lämnats till Göteborgs Universitets Botaniska institutions herbarium (fig. 1).

Det ovan relaterade fyndet av *Asplenium ruta-muraria* väckte helt naturligt mitt intresse för de tidigare kända förekomsterna av arten inom länet. Härtill bidrog också lokalens beskaffenhet (urberg), som föreföll mig egendomlig, då man ju är van att betrakta murrutan som en kalkkrävande art.



Fig. 1. *Asplenium ruta-muraria* L., blad. Skaftö: Islandsberg 3.7.1965. Foto: H. RASPER.

I »Göteborgs och Bohus läns fanerogamer och ormbunkar» uppger FRIES (1945) murrutan för åtta socknar inom länet, nämligen Göteborg, Marstrand, Forshälla, Skredsvik, Uddevalla, Foss, Tanum och Tjärnö. En genomgång av materialet i Göteborgs-herbariet visade, att arten efter utgivandet av FRIES' flora anträffats även vid Kärnsjön i Håby sn och i Stala sn på Orust. Senare har även materialet i Naturhistoriska Riksmuseet genomgåts, varjämte upplysningar inhämtats från herbarierna vid Uppsala och Lunds Universitets Botaniska institutioner och Växtbiologiska institutionen i Uppsala angående där befintliga kollektioner. Det av HARALD FRIES upprättade kartoteket över Göteborgs och Bohus läns fanerogamer och ormbunksväxter, vilket nu förvaras vid Botaniska institutionen i Göteborg, har också konsulterats. Värdefulla upplysningar om artens förekomst på en del av bohuslokalerna har vidare erhållits av folkskollärarna STURE NILSSON och LINUS SPETZ samt rektor MANNE OHLANDER, samtliga i Göteborg, och av folkskollärare STIG WOLDMAR, Uddevalla. Till dem och till vederbörande tjänstemän vid de nämnda institutionerna samt till intendenten BO PETERSON, Fil. lic. CARL-AXEL

JANSSON och vaktmästare H. RASPER vid Botaniska institutionen i Göteborg, vilka på flera sätt varit mig behjälpliga vid genomförandet av denna undersökning, frambär jag mitt varma tack. Göteborgs-lokalerna har inventerats av mig i november 1965 (se nedan). En exkursion har vidare företagits vid denna tid, i sällskap med STURE NILSSON, till borgruinen Ragnhildsholmen vid Nordre älv och till Bohus fästning i Kungälv. På dessa båda platser söktes dock arten förgäves. Lektor HARRY ANDERSSON i Kungälv har haft vänligheten meddela förf., att han förgäves efterforskat murrutan på de båda sistnämnda platserna liksom i Kungälv-trakten över huvud taget och på Brattön.

Det sålunda hopbragta materialet har sammanställts i efterföljande översikt. Förkortningar: Hb.G., Hb.L., Hb.S. och Hb.U.=herbarierna vid de botaniska institutionerna i Göteborg, Lund, Naturhistoriska Riksmuseet i Stockholm och botaniska institutionen i Uppsala resp. En karta över den nu kända utbredningen av *Asplenium ruta-muraria* i Göteborgs och Bohus län har också uppgjorts (fig. 2).

**Göteborg.** På gamla skansmurar (LINDBERG 1878), en kollekt finns i Hb.G. ur herb. C. J. LINDBERG (Otterhällan på en gammal fästningsmur, datum o. namn på insaml. saknas);=Stadsvallen (1862 CMR [RYDÉN], Hb.L.); Otterhällan (1896 ARNE FRIES, Hb.S.);=Kungshöjden, ruinens norra mur mot Kungsgatan, en större o. en mindre koloni c:a 5 m högt (1913 KARL B. NORDSTRÖM, Hb.G.);=bastionen Carolus Rex (FRIES 1924, »ett och annat exemplar»). Bastionen Carolus Rex är belägen på Lilla Otterhällan, som också benämnes Kungshöjd (förf:s anm.). Denna lokal inventerad av förf. 1965, varvid konstaterades, att murrutan förekommer rikligt på alla tre sidorna av de höga murarna, alltså mot Kungsgatan, Esperantoplatsen och Rosenlundsgatan. Delvis med hjälp av kikare kunde i allt ett 70-tal små ytor, bevuxna med arten, upptäckas. — Skansen Kronan (1897 STEN SVENSON, Hb.L.). Denna lokal, belägen knappt 1 km SV om föreg., är ej nämnd i litt. Vid förf:s inventering 1965 kunde inget enda ex. av murrutan upptäckas, trots att själva skansen samt murarna och berget nedanför undersöktes noggrant. — Skansen Lejonet (PALMÉR 1927); uppgiften betecknas av FRIES (1945) som mkt osäker. Arten förgäves eftersökt här av STURE NILSSON (enl. muntl. medd.). Förf:s efterforskningar 1965 gav också negativt resultat.

**Marstrand.** Karlstens fästning, på de inre fästningsmurarna (LINDSTRÖM 1913). FRIES (1945) citerar LINDSTRÖM, som också torde ha prioritet på lokalen, trots att en tidigare daterad insaml. härifrån finns av JOHN BAUMAN 1907 (Hb.S.). O. NORDSTEDT har också insamlat arten här 1912 (Hb.L.), samma år som LINDSTRÖM daterat sin uppsats. I uppsatsen nämns i samband med andra växtfynd mycket noggrant BAUMANS och NORDSTEDTS namn men ej i fråga om murrutan, varav man torde kunna dra slutsatsen, att LINDSTRÖM upptäckt förekomsten. Senare insamlingar från denna lokal: LINDSTRÖM 1919 (Hb.G.), CARL A. FALKENBERG 1919 (Hb.S.), STEN GRAPENGIESSER 1919 (Hb.S.), CARL BLOM 1932 »talrik» (Hb.G.), H. FRIES 1944 (Hb.G. o. S., rikl. kollekter).

**Stala.** Ö om Gunnarsbo, spricka i bergvägg (1952 MANNE OHLANDER, Hb.G.); fyndet publ. av OHLANDER (1958). Enl. muntl. uppg. av upptäckaren förekommer arten i en mot V exponerad brant med lundvegetation.

**S k a f t ö.** Islandsberg, innanför nya fyren (1965 SVANTE SUNESON, Hb.G.). Se närmare ovan!

**F o r s h ä l l a.** Vassbosjöns norra ända (1929 HARALD FRIES, Hb.G., L. o. S., rika kollektioner); lokalen publ. av FRIES (1931) o. omnämnd i redogörelse för Bot. För:s i Gbg exkursion (Sv. Bot. Tidskr. 1941, s. 97), där bl.a. följ. arter från lokalen anförs: *Cardamine impatiens*, *Cotoneaster integerrimus*, *Geranium sanguinem* o. *lucidum*, *Hedera*, *Origanum* och *Campanula trachelium*. En beskrivning av växtplatsen lämnas också av WALDÉN (1965) i en stencilerad rapport över naturskyddsinventering i Gbgs o. Boh. län, där lokalen föreslås som synnerl. angeläget naturskyddsobjekt. Den preciseras här till »strax N om Vassbosjöns NO ände» och beskrivs som »klippsluttning mot S av egenartad, kalkrik bergart». Av växter nämnes utom murrutan bl.a. lind, alm, ask, hassel o. *Mercurialis perennis*.

**U d d e v a l l a.** Kristinedal: »på berget Lilla Sweitz vid Christinedal nära Uddevalla» (1863 K. FR. THEDENIUS, Hb.U.), publ. i HARTMANS flora IX (1864). — Emaus (PALMÉR 1927). I Hb.G. ligger ett ark med rikl. material, insamlat av PALMÉR 1904 o. med lokaluppg. »Uddevalla, Schweiz». Denna lokal torde vara vad P. i sin flora kallar Emaus. Folkskoll. S. WOLDMAR har meddelat förf., att ett parti inom Emaus-området, beläget i stadens södra utkant, förr kallades Schweiz på grund av sina imponerande rasbranter och stup. Kristinedal är beläget knappt 1 km längre åt SV. Om de uppgivna växtplatserna avser samma lokal eller två närbelägna, är svårt att avgöra. PALMÉR, som enl. uppg. av WOLDMAR hade sitt barndomshem i trakten och kände dess flora väl, nämner endast Emaus. FRIES (1945) upptar båda platserna. WOLDMAR (1959) har skildrat den rika lundvegetation, som förekommer inom området, men har enl. medd. till förf. inte lyckats finna murrutan. Han håller det dock för troligt, att uppgifterna avser två skilda lokaler. Fil. stud. ULF WALLER, nu ägare till PALMÉR:s herbarium, har haft vänligheten meddela förf., att murrutan ej finns representerad i herbariet.

**S k r e d s v i k.** Smörkullen (M. FL(ODERUS) utan insaml.-datum, Hb.U.); Smörkullen, tillsammans med *Hedera helix*, sparsamt (1941 NILS GRIMVALL, Hb.G.). H. FRIES (1945, kartoteket i G.).

**F o s s.** Mellan Kvistrum och Saltkällan (SCHEUTZ 1880) = Kvistrum (1929 HARALD FRIES, Hb.G. o. S.), publ. med lokaluppg. »nära Kvistrum» av FRIES (1931). Samma lok. (STURE NILSSON 1934 enl. anteckn. i FRIES' kartotek) även omnämnd av NILSSON (1959, s. 466): Kvistrumsberget »ett par förekomster».

**H å b y.** Ungefär 2,5 km N om Torp, strandklippor vid Kärnsjöns östra strand (1946 STURE NILSSON, Hb.G.) = ? Klippsnisch vid Kärnsjön c:a 1 km N om Ekenäs (1957 LINUS SPETZ o. MANNE OHLANDER, Hb.G.). Viken N om Valbergs flåg (NILSSON 1959, s. 471). Enl. muntl. medd. av STURE NILSSON ligger denna senare lokal nära gränsen till Hede sn. En mindre förekomst är vidare anträffad av LINUS SPETZ (muntl. medd.) vid några jättegrytor ca. 300 m S om sistnämnda lokal. Murrutan skulle alltså finnas på åtminstone tre lokaler vid östra stranden av Kärnsjön (se även redog. f. Bot. För:s i Gbg sammankomster, Sv. Bot. Tidskr. 1948, s. 87). Bergarten på lokalerna uppges vara lättvittrad gnejs, som förmodas vara kalkrik.

**T a n u m.** Nordsidan av viken ung. 1 km OSO om Veddö landförbindelse, »mkt. riklig på en sträcka av 15—20 m på en mörk bergart, troligen grönsten»

(1938 STURE NILSSON, Hb.G.).=L:a Anrås, vid Ramsfjorden (1949 HARALD FRIES, Hb.L. o. S.).

Tj ä r n ö. Sydkoster (BERGENDAHL 1879), aldrig återfunnen (cf. PALMÉR 1927, FRIES 1945).

Som framgår av utbredningskartan (fig. 2), ligger *Asplenium rutamuraria*-lokalerna spridda över länet från Göteborg i söder till Koster i norr. Flertalet lokaler är belägna vid kusten eller de djupt inträngande fjordarna, men ett par kan betecknas som inlandslokaler. Det vill synas, som om växtplatserna i allmänhet är exponerade mot väster, sydväst eller söder, en omständighet som kan ha betydelse, när det gäller att förklara nykolonisation genom fjärrspridning. Av intresse i detta sammanhang är också, att flera lokaler utgörs av höga branter, där sporer kan fångas upp, och att de egentliga inlandslokalerna ligger vid sjöar: Kärnsjön och Vassbosjön.

En del av murrutans förekomster inom området är kända sedan lång tid tillbaka. Så är t.ex. fallet med den på bastionen Carolus Rex inom Göteborgs stad. Här förekommer nu arten mycket rikligt. Men frekvensen torde ha växlat, att döma av de spridda uppgifter, som föreligger. Så anför t.ex. FRIES (1924): »Finnes ännu i ett och annat exemplar å sin gamla lokal i G(öteborg): bastionen Carolus Rex». Den växlande frekvensen kan kanske stå i samband med utförda reparationsarbeten och »städning» av murarna. För närvarande är vegetationen på murarna rik med bl.a. grästuvor, buskar och ungträd. Vid en kommande bortrensning av den högvuxna vegetationen bör i möjligaste mån murrutan aktas. På skansarna Kronan och Lejonet finns arten av allt att döma inte längre kvar. Möjligen har den försvunnit vid skötselarbeten på murarna, som nu praktiskt taget helt saknar högre vegetation. Det är heller inte uteslutet, att de uppgivna förekomsterna på dessa skansar beror på förväxling med bastionen Carolus Rex. Den f.n. rika förekomsten på Carolus Rex är anmärkningsvärd i beaktande av att platsen ligger i den centrala delen av en storstad, med starkt trafikerade gator på tre sidor och alldeles intill ett kraftvärmeverk. Tydligen har växten inte tagit skada av den ökande luftförorening, som nu går förödande fram över exponerad moss- och lavvegetation i storstäderna. I jämförelse med Carolus Rex-lokalen torde den av förf. upptäckta Skaftö-förekomsten få anses som en sen kolonisation, även om man inte utan vidare kan döma av det mycket ringa individantalet. Frekvensen betingas ju också av betingelserna på ståndorten.

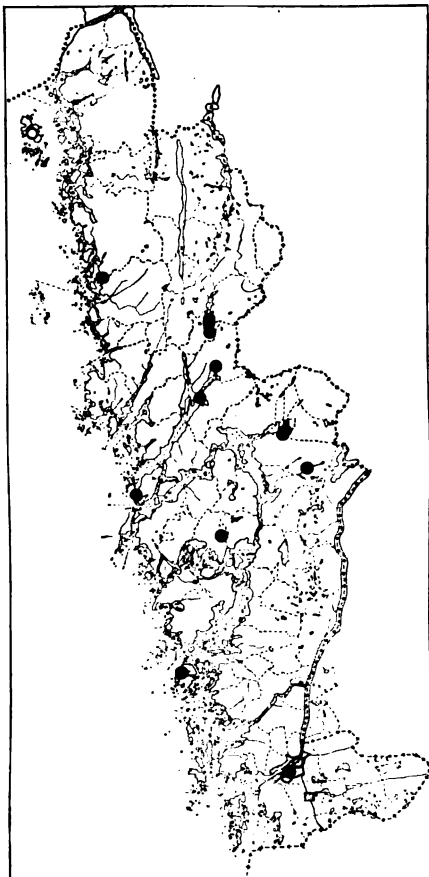


Fig. 2. Utbredningen av *Asplenium ruta-muraria* L. i Göteborgs och Bohus län. Ofyllda ringar (○) anger osäkra eller ej återfunna förekomster.

I fråga om substratets beskaffenhet representerar murrutans förekomster inom vårt område helt skilda typer av lokaler. Göteborgs- och Marstrands-lokalerna utgörs av gamla murar, där växten huvudsakligen uppträder på det kalkrika murbruket i fogarna mellan gråstensblocken. De övriga växtplatserna är klippbranter. Arten betecknas ju ofta som kalkälskande. HÅRD AV SEGERSTAD (1952, s. 43) betraktar den i sin Värmlands-flora som en av de »utmärktaste indikatorerna på kalk». WEIMARCK (1963) betecknar den som  $\pm$  kalkbunden. I vårt land är murrutan vanligast inom de kalkrika landskapen (se utbredningskarta nr. 40 hos HULTÉN 1950). På Gotland och Öland är den allmän (HYLANDER 1953), i övriga landskap spridd eller sällsynt. Förekomsterna i t.ex. Värmland och Södermanland har i allmänhet

kunnat relateras till urkalksten (HÅRD AV SEGERSTAD l.c. och ALMQUIST & ASPLUND 1937). Av intresse i vårt sammanhang är de nyligen publicerade fynden av murruta i Tyresö s:n i Södermanland, där arten förekommer i sprickor i amfibolitgnejs med bergssega och riklig kalkutfällning (RASCH 1965, s. 138, 155). Även ett antal kalkifila mossor uppges för detta område.

Landskapet Bohuslän är i fråga om berggrunden kalkfattigt. Den rika förekomsten av skalgrusavlagringar, inte minst vid foten av bergssluttningar, skapar emellertid flerstädes förutsättningar för en mera krävande vegetation. I nordligaste Bohusläns kustland bidrager även en kalkrik morän till att ge lämpligt underlag för kalkälskande växter. Lokalt kan lättvittrade, kalkrika grönstenar påverka florans sammansättning. Kalkspat (kalcit) förekommer också på sina håll som sekundär utfyllnad i urbergssprickor. När det gäller en art som *Asplenium ruta-muraria*, vilken växer direkt på berget eller i bergsspringor, är det väl närmast dessa båda senare typer av kalkförekomster, som blir av intresse. Tyvärr är uppgifterna om substratets beskaffenhet ofta alltför ofullständiga för att tillåta generella och definitiva slutsatser angående murrutans kalkberoende på de bohuslänska lokalerna. Vissa viktiga uppgifter för bedömningen skall dock redovisas här.

Växtplatsen i Tanums s:n är enl. STURE NILSSON en »mörk bergart, tydlig grönsten». Lokalen vid Vassbosjön i Forshälla s:n är, att döma av den geologiska kartan (Uddevalla), belägen i kanten av ett område med pegmatit. A. H. MAGNUSSON (1942) har på denna murrutalokal funnit två för Bohuslän nya kalkifila lavar, nämligen *Collema polycarpum* Hoffm. och *Verrucaria fuscella* Ach. De växte på en klippa, vars halt av kalciumkarbonat var tillräcklig för gasutveckling vid tillsats av saltsyra. När det gäller Uddevalla-lokalerna (Kristinedal och Emaus), är en notis av LINDSTRÖM (1902) i beskrivningen till kartbladet Uddevalla av största intresse. LINDSTRÖM anför, att kalkspat ganska ofta förekommer i Uddevalla-traktens gnejsgranit som sprickfyllnad, t.ex. SO om Emaus och N om Bratteröd. En färskare uppgift om samma sak har jag erhållit av assistenten vid Geologiska Institutionen i Göteborg LENNART SAMUELSSON, som haft vänligheten meddela mig, att kalcit uppträder som sekundär sprickfyllnad i bergsskärningar vid serpentinvägen S om Uddevalla (Gustavsberg). På Kvistrumberget i Foss s:n tyder enl. NILSSON (1959, s. 465) den rika förekomsten av flera kalkälskande mossor på att gnejsen här är »ovanligt kalkrik». Växtplatserna på östra stranden av Kärnsjön i Håby s:n utgörs enl. muntligt meddelande av STURE NILSSON och LINUS SPETZ



av en mycket lättvittrad gnejs, och närvaron av bl.a. *Sedum rosea* på den nordligaste av dessa lokaler skulle enl. NILSSON (l.c., s. 471) indikera kalk i bergarten här. Murrutans uppträdande på Koster i Tjärnö s:n kan kanske sättas i samband med att berggrunden där består av en lättvittrad gnejsgranit, som genomsättes av gångar av kalkrik diabas (cf. FRISENDAHL 1959). Vad slutligen Skaftö-lokalen beträffar, har jag för närvarande icke möjlighet att säkert uttala mig om substratets beskaffenhet. En stuff från en i sprickan utskjutande gnejslamell har undersökts av assistent LENNART SAMUELSSON med det resultatet, att kalcit eller andra Ca-rika och lättvittrande mineral ej kunde påvisas. Undersökningen omfattade granskning i lupp och studium av ett pulverprov i polarisationsmikroskop. Enl. SAMUELSSON kan kalcit möjligen uppträda som sekundära sprickfyllnader i den aktuella berggrunden. Kanske kan en senare undersökning ge besked om detta och om eventuella förekomster av kalcifila lavar på platsen. De antecknade fanerogamerna kan inte sägas indikera kalk, möjligen med undantag för *Eupatorium cannabinum*.

Som sammanfattning kan sägas, att av murrutans klipplokaler i Bohuslän en säkert har relaterats till kalk och en till grönsten, en ligger i ett område, där kalcit förekommer som sprickfyllnad, och att på några lokaler indicier föreligger på kalkförekomst i någon form.

### Summary

The present paper informs of a new locality of *Asplenium ruta-muraria* on the isle of Skaftölandet in Bohuslän, southwestern Sweden. A survey of all localities of the species, known to-day, in the province of Göteborgs- and Bohus län is given, in addition to a distribution map. At two places, Göteborg and Marstrand, the localities are old fortress walls. A very rich locality is situated in the centre of Göteborg, where the plant seems to endure very well the air pollution of to-day. At the other places the species occurs on Archaean rocks, often with an exposition to the west or to the south. The gneiss and the granite, however, may be intermingled with calciferous material. In one locality the substratum was shown to be limestone, and the fern was here accompanied by two calciphilous lichens. In another locality the substratum consists of a sort of greenstone. In some other localities there are also indications of lime in the substratum.

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## Studies in Prelinnaean and Early Linnaean *Tropaeolum* Taxonomy and Nomenclature

### 1. *Tropaeolum peregrinum* L.<sup>1</sup>

By BENKT SPARRE

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#### Introduction

LINNAEUS named in all five species of *Tropaeolum*, *T. minus*, *T. majus*, *T. hybridum* and *T. peregrinum*. The latter binomen was unfortunately used twice, which of course created a lot of misunderstandings. Suspicious that the problem was still worse, I visited in 1964 the Linnaean Herbarium in London, and I found that I had been right — there was still another species involved in the Linnaean material. A thorough study was needed to clarify the problem involved.

This short paper is a preliminary part of my forthcoming monographic treatment on the *Tropaeolum* family, which is almost ready for print. It will be followed by a second part, including the remaining three species.

As three different *T. "peregrinum"* will be discussed, they will be separated with the abbreviations (F), (D) and (M), i.e. FEUILLÉE's plant=LINNAEUS 1753, DUCHESNE's species=LINNAEUS 1771, p.p.=*T. hayneanum*, and MUTIS' species=LINNAEUS 1771, p.p.=*T. smithii*.

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I am greatly indebted to the Director of the Botanical Department of Naturhistoriska Riksmuseet, Stockholm, Professor TYCHO NORLINDH — the object of the festive proceedings of the day — for all help rendered during my work at the museum. I express also my sincere thanks to the Direction of the Linnaean Society in London and especially to its honorary curator, the late Dr. N. Y. SANDWITH, Kew. To all museums and institutions, which helpfully have

<sup>1</sup> Partly presented at Nordisk förening för taxonomisk botanik, in Lund, June 1965; autoreferate in Bot. Not. 118: 448 (1965).

sent material and photos, I should like to express my deepest sense of obligation.

The English text has been revised by Mrs. AINA SCOTLAND, Stockholm, and the Latin diagnosis by Miss ADELAIDE STORK, Fil.lic., University of Stockholm. To both I present my sincerest thanks.

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### Historical sketch

In 1753, when *T. peregrinum* was validly published, LINNAEUS clearly stated that he had not seen the plant ("nondum mihi visi in Europa"). The species was created entirely and exclusively on FEUILLÉE's description and picture (1714) (cf. fig. 1). The description is rather good; the only error being perhaps that FEUILLÉE made a mistake in the position of the petals. So is the plate, even if the 3 inferior petals are lacking, which was to cause a lot of diffusions in the XIX century.

During the decade of 1760, probably towards the end, LINNAEUS received 2 sheets from DUCHESNE in Paris (LINN 481, 5—6). They had been cultivated at the Royal Gardens and had probably been received as seed from JOSEPH DE JUSSIEU, who lived and travelled in Peru 1736—71. LINNAEUS now apparently made a mistake in under-rating FEUILLÉE. He made a new description for *T. peregrinum* (1771), without mentioning the earlier description. The new plant was to be found in several botanical gardens during the end of the century; so is e.g. the plate in LAMARCK 1793 indubitably made after living material (cf. fig. 2), and not entirely corresponding with the description (1783).

After the publication of Mantissa altera in 1771, LINNAEUS received more material of *Tropaeolum*, this time from MUTIS in Bogotá, Colombia (LINN 481, 7—8). This was incorporated in the herbarium without any annotation by LINNAEUS himself, or by the younger LINNAEUS. Later, after the purchase, J. E. SMITH added some notes. Nr. 7 (MUTIS 77) is of no interest, while nr. 8 (MUTIS 75) has a long and surprising annotation: "... det. L. *Tropaeolum peregrinum* — nova granada — H.B. [=herbarium banksianum] — species ex Herb. Lin.". As the only *T. "peregrinum"* in the Linnaean herbarium was DUCHESNE's specimina, it is clear that SMITH meant that MUTIS' material was the same.

The confusion was great already, when SMITH brought the Linnaean herbarium to London, but it was still growing, now with SMITH as a more or less innocent promotor. Believing that the material in the



Fig. 1. "*Cardaminum quinquefido folio, vulgò Malla*". — From FEUILLÉE, 1714: Pl. XLII.

herbarium was homogeneous and wholly corresponding with *T. peregrinum* of 1771, he rejected FEUILLÉE and LINNAEI *T. peregrinum* of 1753 — which LINNAEUS apparently had done, too. With that case happily settled, there was nothing to prevent the description of FEUILLÉE's plant anew as *T. aduncum*, when he found it during his continental trip (1793, nomen; 1819).

Around the turn of the century *T. peregrinum* frequently appeared in the literature. The citations — especially according to older bibliography — were often rather confusing. So LAMARCK (1783) cites both FEUILLÉE and LINNAEUS 1771, but gives a description of a mixture of DUCHESNE's and MUTIS' plants; the locality “. . . Perou, & est cultivée au Jardin du Roi” only indicates DUCHESNE's plant, and so does the excellent illustration (1793). Nothing is said about a hooked calcar or different petals. HELLENUS (1789), who had had access to the Linnaean herbarium in Uppsala, also described a mixture of the two species (D+M), but did not cite any older bibliography. JACQUIN (1797) gave a good description and a most excellent plate of the true species (F) under the correct name. Finally also WILLDENOW (1799) succeeded in mixing all three species under the same heading. In the beginning of the new century, however, there appeared several good illustrations of *T. peregrinum* under the correct name (cf. below).

In 1819 SMITH eventually published his *T. aduncum* with *T. peregrinum* Jacq. [sic!] as a synonym. The material in the Linnaean herbarium was still presented as *T. peregrinum* L., 1771 (viz. D+M). FEUILLÉE's plate, “if good for anything, must belong to a different species”. This disposition was gladly taken up by DE CANDOLLE, who in 1824 started an attempt to get some order in the post-linnaean nomenclature. In the topical case he followed SMITH almost entirely. *T. aduncum* was retained in the interpretation of SMITH. *T. peregrinum* of 1753 (F) was consequently wholly rejected, and placed as a synonym to *T. dipetalum* R. & P.; most distressing, as we will notice later. SMITH's *T. peregrinum* (D+M) was impossible to use as a name, without risking severe misunderstandings, and was renamed *T. smithii*.

G. DON (1831) followed suit, but STEUDEL (1841) refused the new name *T. smithii* and kept *T. peregrinum* as a valid species, different from *T. aduncum*. Not before 1853 did WALPERS recognize *T. smithii*. OTTO (1849), in a confusing list of the family, had all the three involved species, viz. *T. aduncum*, *T. peregrinum* L. [sic!] and *T. smithii*. In 1846 we also paid the consequences of DE CANDOLLE's error, when

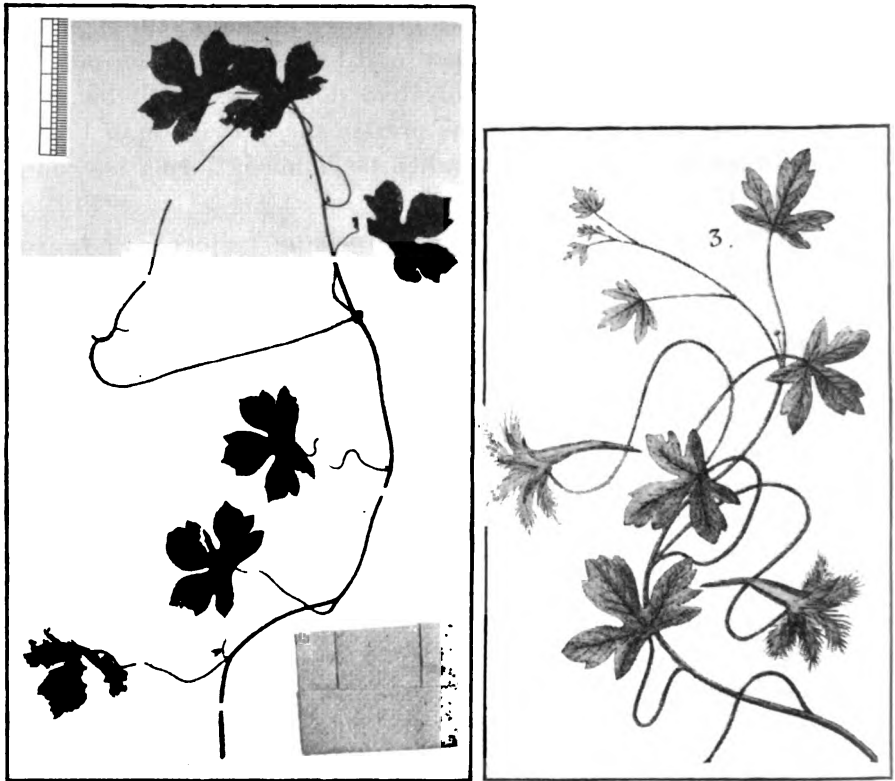


Fig. 2. The Paris specimen of DUCHESNE's species, together with *T. "peregrinum"*, sensu LAMARCK, 1793: tab. 277, 3. — A homogenetic origin might easily be suspected.

MORREN published a good picture of the true *T. peregrinum* under the name of *T. dipetalum*.

Also KLATT (1859) tried monographically to get some order in the genus. *T. smithii* and *T. aduncum* were presented as good species and DE CANDOLLE's and MORREN's peculiar *T. dipetalum* was renamed *T. morreanum* — differences from *T. aduncum* "besteht nur in der Blatttheilung und in den Einschnitten der obern Kronenblättern". For once there is no stray *T. peregrinum* present, but instead appears near *T. smithii* a new binomen of great topic interest, *T. hayneanum*. This had been described in 1843 in a rather obscure garden journal by BERNHARDI. According to the description it had recently been introduced in Europe from Peru. No wild material was ever preserved; the only exception is maybe a sheet in K. As it was distributed to different

botanical gardens, there are several collections of cultivated material preserved in the different herbaria. It was reported and discussed in several papers, but nobody ever mentioned that the species already was well known, yet unnamed. It was DUCHESNE's species, which modestly reappeared in the taxonomy.

Also *T. hayneanum* gave birth to a series of misinterpretations. MARKHAM, who travelled in Peru in the middle of the last century, gave in his narrative (1862) the name *T. canariensis* to a lovely *Tropaeolum* he found growing in indigenous tilled fields. SEEMANN (1863), who received the collected material, correctly rejected this name (cf. below), and made an attempt with the new *T. hayneanum*. This was anyhow wrong, and the error was later corrected by BUCHENAU. In 1949, MACBRIDE anew listed wild material of this species, but also that was an error; what he had was a new species, below named *T. calcaratum*.

In 1892, BUCHENAU started his thorough treatment on *Tropaeolum*, which ended with his monograph in Pflanzenreich (1902). He was not the first one to tell that FEUILLÉE's picture, LINNAEUS 1753 and *T. aduncum* were one and the same (that might have been REGEL in 1874), but he firmly and finally stated the case, and *T. aduncum* now disappeared entirely, with exception of commercial catalogues. *T. dipetalum*, sensu DC. and MORREN, and consequently *T. morreanum*, were listed as synonyms. *T. smithii*, with *T. peregrinum* L. 1771 (D+M, incl. LAMARCK, HELLENIOUS and SMITH) as synonym, was of course a good species. *T. hayneanum* was listed according only to BERNHARDI's original description, and SEEMANN's species was correctly described as a new species, *T. seemannii*. With the exception of some rather conceited ideas and an often shown anglophobia, BUCHENAU was upon the whole quite right — the only grave error he made was not recognizing that DUCHESNE's and MUTIS' plants were different, but he probably never visited the Linnaean collection in London.

Before ending this historical sketch, we have to consider a further name viz. *T. "canariense"*. It was only a garden name — as I can find first verified in more serious literature in 1866. It is based already in SMITH's narrative as a vernacular name, "Canary bird flower" or "Canary creeper". It is still going strong in horticultural lists; gardeners are, as we all know, all rather conservative.



Nasturtij Indici icon missa.



Fig. 3. "*Nasturtij Indici icon missa*". — From DODONAEUS, 1584: pag. 420, a reprint of DODONAEUS, 1574: pag. 471.

### Dodonaei *Tropaeolum* (?) species (fig. 3)

"*Nasturtium Indicum*", DODONAEUS, 1574: 473, tab. pag. 471; LOBELIUS, 1576: 338, cum tab., 1581: tab. 616, 1591: tab. "166" (=616); DURANTE, 1585: 277, tab., non textu; DALECHAMPS, 1587: 657, cum tab., CAMERARIUS, 1588: 105; PARKINSON, 1640: 1378, tab. pag. 1379.

"*Nasturtium Indicum, folius angulosis*", DODONAEUS, 1583: 420, fig. "*icon missa*"; BAUHIN & CHERLER, 1650: 176, cum fig.

According to his second work (1583), DODONAEUS rather regretted his first note on the peculiar plant he had published in 1574. To get out of the mess he called his picture "*icon missa*" — something they had sent to him — and joined LOBELIUS in his opinion on the true "*Nasturtium Indicum*" — the picture accordingly called "*vera icon*" — which was to become *Tropaeolum minus*. I think none of the botanists of the 16th and 17th centuries, who cited DODONAEUS, ever really believed in the plant, but they were perfectionists, and all plants described must be mentioned. DODONAEI drawing was reprinted in book after book, first with the slender stem turning left; later turning right. The only individualist among the lot was the Italian CASTORE DURANTE, who either wholly misunderstood DODONAEUS and LOBELIUS, or quoted

a fairy tale. He was the first to turn the plant to the right, and he affixed a nice little town with crenulated towers to the picture. The grave error he made was to affix this illustration to a description of the true "*Nasturtium Indicum*", i.e. LOBELII plant, adding that the species was to be found "in Roma, in molti giardini . . .".

After BAUHIN & CHERLER to a certain degree had finished the describing "Kräuterbuch" epoch in 1650, DODONAEI "*Nasturtium Indicum*" slept quietly for more than 240 years. It is true that LINNAEUS cited DODONAEUS in *Hortus cliffortianus* and in *Hortus upsaliensis*, but what he meant was LOBELII "*Nasturtium Indicum*" on the same page. In 1892 (pag. 183), BUCHENAU — who never saw DODONAEUS 1574 (what he discusses is DODONAEUS 1583) — reopened the problem; perfectionist, as all good Teutons, he had to find a place for DODONAEI plant. The curved, almost hooked, calcar and the odd looking three inferior(?) petals invited to a guess on *T. peregrinum*, as well as older botanists had guessed on *Delphinium* or *Convolvulus*. The "hooked" calcar in my opinion, might as well be a partly dried up *T. minus*, and the peculiar small inferior petals are pictured also by HERNANDEZ (1651: 161) and FEUILLÉE (1725: tab. 8), which both are typical *T. minus*. The angulate leaves, however, do not apply to any known specimens of the family, in spite of BUCHENAU's statement that they are in fact "schwach schildförmigen". That they have "schwach gelappten und fast dornspitzigen Laubblättern" is more a criterium against *T. peregrinum* and that the plant was sent to Europe by "a monk in Spanish America" is just a fairy tale, without any bearing in the literature.

The plant may very well be a *Tropaeolum*, but we may also guess at a lot of other genera. There is no reason to guess just at *Tropaeolum peregrinum*.

DALECHAMPS' name "*Nasturtium peregrinum*" (l.c. 656) is clearly a *Tropaeolum minus*; the similarity in name with *T. peregrinum* is a pure coincidence.

### Relationship of involved species (cf. fig. 4, 5)

In the confusion over LINNAEI *T. peregrinum* of 1771, viz. DUCHESNE's and MUTIS' species, it is rather peculiar, that the two species are not at all related, or originate from the same region. MUTIS' *T. smithii* is a perennial tropical plant from northern South America, while the complex of species around the true *T. peregrinum* are Andean annuals

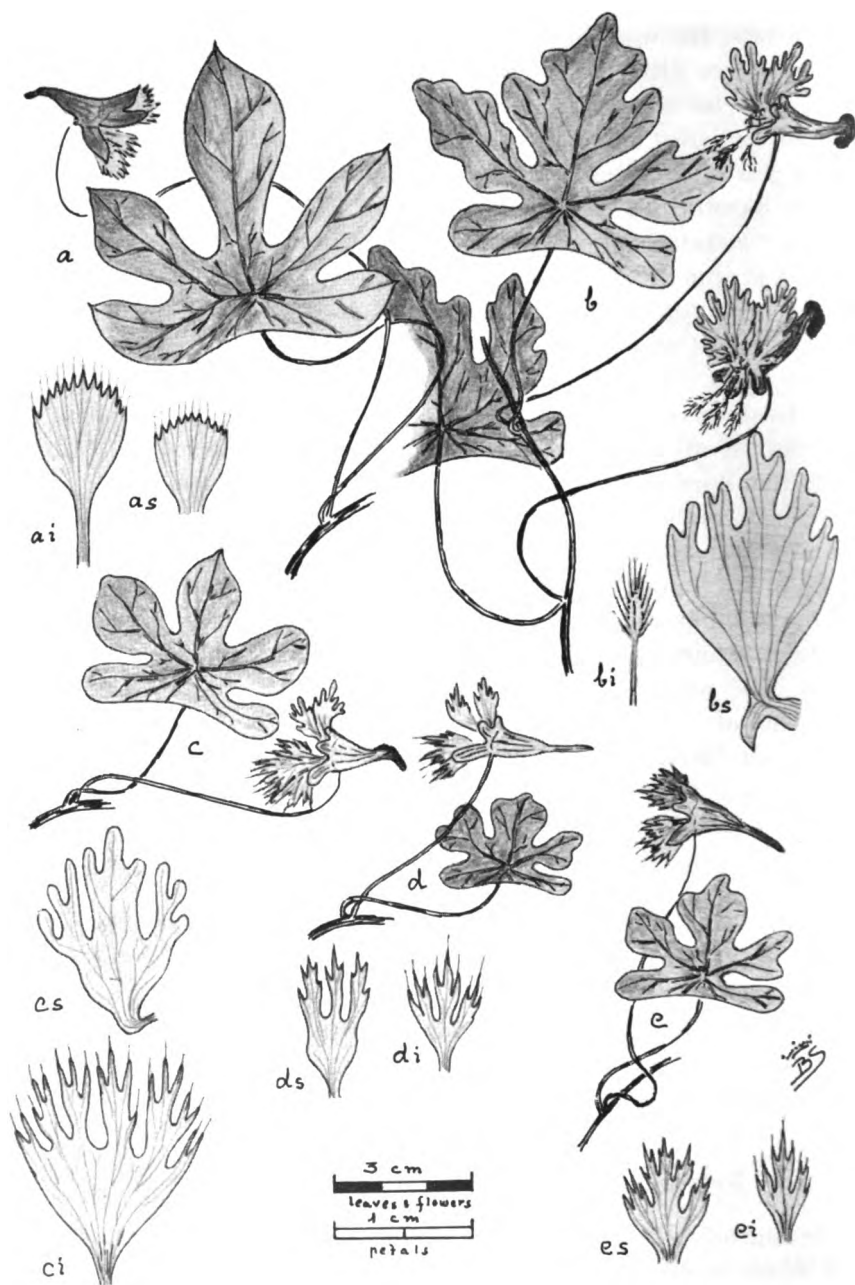


Fig. 4. Flowers, leaves and petals of species involved in the *Tropaeolum peregrinum* problem. — Original. a. *T. smithii*. b. *T. peregrinum*. c. *T. seemannii*. d. *T. calcaratum*. e. *T. hayneanum*. (i. inferior petals; s. superior petals).

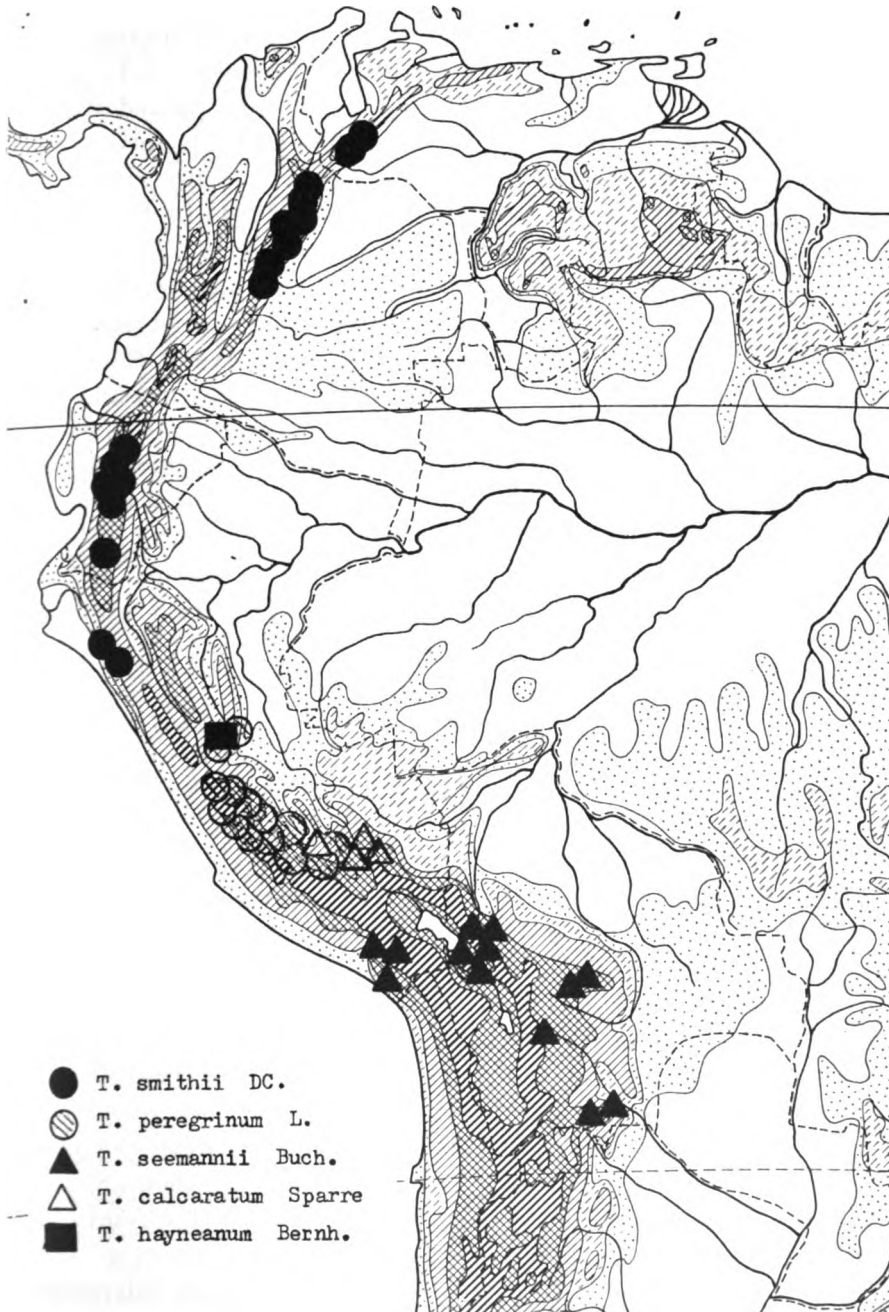


Fig. 5. Known distribution of species involved in the *T. peregrinum* problem.

from Peru and Bolivia. It is still more astonishing, that the same error was repeated as late as around 1900, when RUSBY and GLAZIOU classified species belonging to the *T. peregrinum* complex as *T. smithii*. The similarity stops with a pure superficial likeness: fringed and fimbriate petals and 5-lobed leaves — entering in details there is very little kinship between the two groups. *T. smithii* in my forthcoming systematical treatment forms a small natural section of two species: the other one the showy *T. bicolor* R. & P. from Peru.

The *T. peregrinum* group forms a well defined subgenus, *Canariensia* (SPARRE, ad int.), of 17 species, principally based on the presence of a carpophore. The subgenus is easily recognized also without fruit: in short, the species all look more or less like *T. peregrinum*. Inside the subgenus, anyhow, *T. peregrinum* stands alone with its characteristic hooked calcar and the peculiarly reduced inferior petals. The form of the petals is, anyhow, of great interest, and the specific differences inside the subgenus is almost entirely based on this character.

The remaining three species in our discussion, *T. seemannii*, *T. calcaratum* and *T. hayneanum*, together form a close kinship; it is only to be regretted that we know very little of the wild *T. hayneanum* and its variation amplitude.

The subgenus *Canariensia* is southern in its main distribution. It is bicentric with its principal area in the Andes between central Peru and northern Argentina and a disjunct area in SE Brazil, thus showing an interesting old type of South American distributions. Several species show a striking type of point endemism, being confined to very limited valley systems, etc. Preliminary, before my monograph appears, I can say that plant-geographically the *Tropaeolaceae* show very interesting aspects on a type of distribution that is older than the Cordillera de los Andes. All criteria of origin are in favour of a southern evolutionary centre — in Patagonia — and secondarily in the geologically very old SE Brazilian highlands and in places in western South America (Chile or/and Bolivia?), now considerably more elevated. The evolutionary trend has gone from south to north. Dr. KIM-LANG HUYNH, Neuchâtel, who visited the Palynological Laboratory in Stockholm-Solna in 1965, has collaborated with a study on the pollen in the family. For the most part his research has been in favour of my theories on the phylogeny. His extensive paper is now in print for Grana Palynologica.

### Conclusion

The conclusion of this discussion will be that LINNAEUS *T. peregrinum* (1753+1771) did not involve only two species, which was earlier believed, but three. This basic confusion consequently gave rise to a series of misunderstandings. My present paper is written to clear up the mess, and I hope that at least some of the more confusing cases now are placed in right systematic kinship. The following synopsis of involved species shall, I hope, give a clear concept of most, if not all, involved binomina. I have tried to keep the bibliography complete at least until the end of the "post-linnaean" epoch, viz. until DE CANDOLLE (1824). This criterium has, anyhow, been followed very subjectively; what I have presented is what I myself think of interest for the topic.

BUCHENAU's theory that *T. peregrinum* was the first *Tropaeolum* ever described is highly doubted, but not wholly rejected.

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### Synopsis of involved species (fig. 4, 5)

*Tropaeolum smithii* DC., Prodr. 1: 684 — 1824; G. DON, 1831: 746; OTTO, 1849: 306; WALP., 1853: 838; KLATT, 1859: 215, 218; BUCH., 1892: 211, 1902: 22; MACBR., 1949: 619. — non RUSBY, 1896, nec FOSTER, 1958. — Orig coll.: MUTIS 75: "nova granada" / det. J. E. SMITH: *T. peregrinum* — LINN 481, 8 — LECTOTYPUS.

*T. peregrinum* L., (SMITH, in sched., LINN), sensu LAM., 1783: 612, p.p., non 1793: tab. 277, 3; HELLENIUS, 1789: 18, p.p.?; WILLD., 1799: 299, p.p.; SMITH, 1819: nr. 4, p.p.; STEUD., 1841: 721, p.p. — non L. 1753, nec L. 1771. — Orig. coll.: Based on LINN 481, 5—8, including *T. smithii* and *T. hayneanum*.

*T. digitatum* Karst., Allg. Gartenz. 19: 301 — 1851, Fl. Colomb. 1: tab. 43 — 1858—61; WALP., 1857: 397; KLATT, 1859: 216, 219; REGEL, 1884: 65; BUCH., 1892: 212, 1902: 22. — non GLAZIOU 1905. — Holotypus: KARSTEN s/nr.: [Venezuela:] Mérida, "cerca de La Grita, 2000—2500 m" — W.

*T. gaertnerianum* Haage & Schmidt, in REGEL, 1884: tab. 1164, non textu — No material cited.

I c o n.: Bot. Mag. 74: tab. 4385 — 1848, reproduced in Fl. des serres 4: tab. 384 — 1848; KARST., l.c.; HAAGE & SCHMIDT, l.c.; BUCH., 1892: 178, 1902: 3. — Fig. 4 a.

Geogr. distr.: *T. smithii* is one of the widest dispersed species inside the genus, ranging from SW Venezuela (Est. Trujillo, Mérida) to northern Peru (dep. La Libertad, Ancash). It is bicentric, lacking in southern Colombia. Grows in the upper rain forests, between 2000 and 3400 m above sea level. (Cf. fig. 5 a.)

The species has erroneously been cited for Bolivia (RUSBY, 1893:12, FOSTER, 1958:105) and Brazil (GLAZIOU, 1905:78). In both cases the errors were based on confusions with species near related to *T. peregrinum*, viz. *T. seemannii* (cf. below) and *T. warmingianum* Rohrb. A collection in W: "Chile, Chiloé / leg. PEARCE" is most probably from Ecuador, where PEARCE also collected.

Linnaean or early post-linnaean material.: MUTIS 75 (LINN 481, 8 — Lectotype, cf. above); MUTIS 77 (LINN 481, 7); MUTIS s/nr. (BM). All from Colombia ("nova granada") and probably collected in the vicinity of Bogotá.

Cult.: There are no records that *T. smithii* was cultivated in Europe during the 18th century. Apparently it was not brought here before the eighteenthforties — according to VAN HOUTTE (1857:46) it was introduced in 1848 by the VEITCH commercial house (LOBB?); a specimen in CGE more or less verifies this statement. It frequently appeared in horticultural literature during the second half of the last century, in spite of REGEL (1874:15), who clearly stated that the species was entirely out of culture in Europe. (Anyhow, he describes in 1884 *T. digitatum* from a commercial greenhouse). More or less atavistically it still appears in BAILEY (1950:3391 — as *T. digitatum*) and CHITTENDEN (1956:2156).

It may also be noted than VAN HOUTTE (l.c.) suspected *T. smithii* to integrate as a factor in the common garden Nasturtium. A striking, but very little realistic guess, in my opinion.

*Tropaeolum peregrinum* L., Spec. plant. 345 — 1753, 1759:998, 1762:490, 1767:263 — non Mantissa alt. 371 — 1771; ?MURR., 1774:295; LAM., 1783:612, p.p. — non 1793: tab. 277, 3; HELLENIIUS, 1789:18, p.p.; JACQ., 1797:51; WILLD., 1799:299, p.p.; R. & P., 1802:76; (SMITH, 1819: nr. 4, p.min.p.?); HBK., 1821:252; REGEL, 1874:14; BUCH., 1892:222, 1896:165, 1902:27; MACBR., 1949:617. — Orig. coll.: No authentical material known; LINNAEUS made his description on FEUILLÉE, Journ. obs. phys., math. & bot. . . . 2:756, tab. 42 — 1714: "*Cardaminum quinquefido folio, vulgò Malla*" — the plate is consequently the LECTOTYPUS of the species. (Fig. 1).

*T. aduncum* Sm. [1793:158; SALISB., 1796:275, nomen] in REES, Cyclopaedia 38: nr. 5 — 1819; DC., 1824:684; G. DON, 1831:746; STEUD., 1841:721; KLATT, 1859:216, 220. — Orig. coll.: SMITH s/nr.: "1. Hortus D. GRANIER, Nismes, 1786. 2. Hortus D. GIVYN, 1791" — Hb. SMITH 652, 2 — LINN — HOLOTYPUS.

*T. dipetalum* R. & P., sensu DC., l.c.; MORREN, 1846:95; ?HEMSLEY 1878:442 — non R. & P. — An attempt to explain FEUILLÉE's picture; no authentic material preserved.

*T. morreanum* Klatt, 1859: 216, 219 — A new name for the former, based principally on MORREN's plate.

[*T. canariense*, hort., ex LINDL. & MOORE, Treas. Bot. 212 — 1866 — A commercial catalogue name, never validly published, but unfortunately often used.]

**Icon.:** (For a complete list, cf. *Index londonensis*, under *T. aduncum* and *T. peregrinum*) FEUILLÉE, l.c.; JACQ., l.c. tab. 98; ANDREWS, 1810: tab. 597; Bot. Mag. 33: tab. 1351 — 1811; Bot. Reg. 9: tab. 718—1823; MORREN, l.c., tab. 57; BUCH., 1892: 224, 1902: fig. 10 F. — Fig. 4 b.

**Geogr. distr.:** According to BUCHENAU (1892: 224) the origin of *T. peregrinum* was dubious, but probably Peru; in 1902 (p. 27) he gave "Peru, Ecuador(?)" as native countries. Clearly, this shows how little the botanists during the last century knew of the species; e.g. the note on Ecuador is surely based on cultivated material, but so are probably several localities in MACBRIDE's Flora of Peru. The species is, anyhow, known as wild from central and SE Peru (dep. Junin, Huancavelica, Apurimac, Cuzco); cf. fig. 5 b. Except for some of the collections made by RUIZ and PAVÓN, which also might be of cultivated origin, there exist no older wild collections of *T. peregrinum*. Most of the recent collections have been collected in or near villages or on cultivated ground, usually between 2500 and 3400 m above sea level.

FOSTER (1958: 105) listed *T. peregrinum* as wild in Bolivia, which certainly is an error. It is either cultivated, or, more probably, a confusion with *T. seemannii*.

**Classical material** (wild or suspected to be): "Herb. Pavón / Peruvia" (BM, G).

**Cult.:** If there are no wild specimina from the Linnaean or post-linnaean epoch, we have, however, a lot of material collected during that time in the European gardens. BUCHENAU (1902: 28) gave 1790 as the year of introduction, which is too late, but G. DON (l.c.) stated 1775, which is about right. The oldest specimen seen is a sheet in BM "hort. Kew — 1775". In 1778 the species was collected at Teneriffa (BM) and from the seventeneighties we have the localities given by SMITH in his narrative (Gibraltar, Montpellier), the type collection of *T. aduncum* (Nîmes, ?London), and finally a specimen in the Thunbergian herbarium in UPS (651, 8) — this might, however, have been collected later.

Most probably the species was cultivated in South America long before it was brought to Europe. FEUILLÉE saw it in a residential suburb of Lima, where it surely does not grow wild. RUIZ and PAVÓN



mention it as cultivated, and I have seen early collections also from Mexico (1827 — M). HERRERA (1941: 285) notes that it is common in the gardens around Cuzco and used for uterine troubles.

For the present, *T. peregrinum*, together with the common *T. majus*, is the only *Tropaeolum* generally cultivated around the world.

*Tropaeolum seemannii* Buch., Bot. Jahrb. 15: 226, fig. — 1892, 1896: 166, 1902: 28, fig. 10 H; HERRERA, 1941: 285; MACBRIDE, 1949: 618; FOSTER, 1958: 105. — Orig. coll.: MARKHAM s/nr.: [Peru:] Arequipa, "T. canariensis, growing amongst the maize in the campiña of Arequipa" — BM — HOLOTYPE. BUCHENAU cited also "Gardens of Lima (MIERS)" based on SEEMANN (1863: 129): "MIERS . . . thought he remembered seeing the plant in the gardens of Lima". MIERS had been more than 30 years in Europe, when he remembered that!

[*T. "canariensis"*, sensu MARKHAM, 1862: 78, nomen. — cf. above.]

*T. heyneanum* Bernh., sensu SEEMANN, 1863: 129, tab. 5 — non BERNH. — Orig. coll.: MARKHAM: Arequipa; cf. above.

*T. smithii* DC., sensu RUSBY, 1896: 12, & FOSTER, l.c. — non DC. — based on the wrong determination of RUSBY 759: Bolivia, La Paz, 11,000 ft, IV.1885 — NY, US.

*T. rectangulum* Buch., Bot. Jahrb. 22: 165 — 1896, 1902: 28; FOSTER, l.c. — Orig. coll.: 1. MANDON 771: "Bolivia, vicinitis urbis La Paz, in sepibus ad canalium marginem, alt. 3700 m, 1859 — B (destroyed), G, P, S, W. 2. O. KUNTZE s/nr.: [Bolivia:] Rio Tapacari, 2000—3000 m, 18—19.III. 1892 — NY. 3. O. KUNTZE s/nr.: [Bolivia:] Tunari, IV—V.1892 — NY. — No lectotype decided.

*Trophaeum rectangulum* (Buch.) OK., 1898: 33.<sup>2</sup>

*Trophaeum rectangulum* var. *bicolor*, var. *pallidum* OK., l.c. — colour forms, probably based on field annotations; no corresponding material seen.

I c o n.: SEEMANN, l.c. (copied in BUCH., ll. cc. 1892, 1902). — Fig. 4 c.

Geogr. distr.: *T. seemannii* shows a bicentric distribution with one area around Arequipa in SW Peru (dep. Arequipa, Tacna), the other in Bolivia, on the eastern slopes of the Cordillera (dep. La Paz, Cochabamba, Potosí, Tarija). Partly, e.g. around La Paz, quite common. Seems to be bound to cultivated land. In the Arequipa zone growing at 1500—2400 m above sea level; in Bolivia it reaches up to about 3700 m.

HERRERA (1941: 285) has mentioned the species for Cuzco. I have

<sup>2</sup> KUNTZE (1891: 97, 1898: 33) referred all known species — good as well as synonyms (also *Epilobium denticulatum*, just to be sure) — to the "prelinnaean" genus *Trophaeum*. Involved in the topic of this paper are *Tropaeolum aduncum*, *T. digitatum*, *T. hayneanum*, *T. peregrinum* and *T. rectangulum*, but for some reason not *T. smithii*.

not seen any material corresponding to this note; it might have been cultivated. An ANDRÉ (& PORTMANN) collection (nr. 514) in K and P is labelled "Equateur"; also this must have been cultivated, as none of the two named collectors ever visited Peru or Bolivia.

**Material and cult.:** No older material is known. In spite of being one of the most beautiful species in the genus, it has apparently never been brought to Europe for ornamental purpose, which is rather a pity. It might have been cultivated in South America.

*Tropaeolum calcaratum* Sparre, n. sp.

**HOLOTYPUS:** C. VARGAS 7113: PERU: Cuzco, Anta, Sisal-Cunyac, 2100 m, 26.III.1948 — US; isotype in CUZ, LIL.

*T. hayneanum* Bernh., sensu MACBR., Fl. Peru 3, 2: 613 — 1949, p.p., excl. loco class. *T. hayneani* Bernh.

Planta gracilis, volubilis, annua, glabrescens; caulis (ex sched.) 1—2 m altus. Petioli pedunculis breviores, graciles, usque ad 5 cm longi; laminae suborbiculares, 2—3 cm longae, 2,5—4 cm latae, basi subcordatae, 5-lobatae, lobi medii 3 saepe 3-lobulati, obtusi, breviter mucronati.

Flores axillares, pseudoracemosi; pedunculi robusti, usque ad 6 cm longi. Calyx heteromorphus; sepala virentia, inf. 2,5×7 mm, obtusa, sup. 2×6 mm, anguste triangularia, acuta vel subacuta; calcar 22—25 mm longum, rectum, supra medium incrassatum, flavum, purpureo-nervosum, apicibus purpureis. Petala flava, nervis obscureis, sed normaliter non purpureis; inf. longe (1/3) unguiculata, 8 mm longa, laminae orbiculares, 3-lobatae, 3—4 mm latae, lobi multilobulati, lobuli anguste lanceolati, acuti, fimbriati; sup. breve (1/5) unguiculata, 12—13 mm longa, 5—6 mm lata, 3-lobata, lobi lobulati, acuti, fimbriati. Fructus supra gynophorum, 3-carpellatus, carpelli subrotundi, ut maturi 6—7 mm longi, obscuri.

**I c o n.:** Fig. 4 d.

The new species shows a certain kinship with *T. seemannii*, but is probably nearer related to *T. hayneanum*, with which MACBRIDE confused the material. It is anyhow well distinguished, especially through the colour and size of the petals.

**Geogr. distr.:** Growing in almost xerophytic vegetation of open slopes or shrub forests, between 900 and 2300 m above sea level. Known only from SE Peru (dep. Apurimac, Cuzco). Cf. fig. 5 d.

**Revised material:** PERU: Apurimac: Abancay, Carahuasi, II.1950, MARIN 1920 (LIL). — Cuzco: Convenzi3n, Echarate, 900 m, 3.II.1939, STORCK, HORTON & VARGAS 10498 (F, UC); ibid., entre Rosalina y Quellouro, 700 m, 9.VIII.1958, VARGAS 12301 (CUZ, S); ibid., Pintobamba, 950 m, XII.1948, MARIN (LIL); Anta, VARGAS 7113 (type coll., cf. above); Mallepata, Valley of Rio Colorado, 2500 m, 16.IV.1957, ELLENBERG 1148 (U); Calca, Lores valley,

12.II.1929, WEBERBAUER 7942 (F). — Not localized locality: "Quebrada Versailles", IX.1925, DIEHL 2417 (F).

*Tropaeolum hayneanum* Bernh., Allg. thüringer Gartenzeitung 2: 73 — 1843; WALP., 1843: 820; VON WINTERFELDT, 1845: 108; KLATT, 1859: 215, 218; BUCH., 1892: 218, 1902: 25. — Orig. coll.: According to BERNHARDI's original description, the species was collected at Huánuco in northern Peru by WINTERFELDT; no authentic material is preserved. BERNHARDI received anyhow seed and cultivated the species in his own garden at Erfurt. A sheet now preserved in MO, originating from BERNHARDI's herbarium and "probably from BERNHARDI's garden at Erfurt", must be selected as LECTOTYPUS. Contemporaneous collectings, most probably emanating from BERNHARDI's garden, and that of Mr. HAYN in Schlesien, are preserved in B ("hort. berol. 1848" — now destroyed — Photo F. 18268), GH ("hort. Lipz. — KUNZE"), and W ("Hb. 46. Ego" and "Erfurt, HAAGE & SCHMIDT . . [ . . ?] 83").

*T. "hayneanum"*, auct. hort. & Ind. kew. — non SEEM. — orthographic error.

*T. peregrinum* L., 1771: 371 — non Spec. plant. 1753; MURR., 1774: 295; LAM., 1783: 612, p.p., 1793: tab. 277, 3; HELLENIIUS, 1789: 18, p.p.; WILLD., 1799: 299, p.p.; SMITH, 1819: nr. 4, p.p.; STEUD., 1841: 721, p.p. — Authentic material: LINN 481, 5—6, sent to LINNAEUS from DUCHESNE in Paris, probably originating from J. DE JUSSIEU in Peru.

*T. smithii* DC., 1824: 684, p.p.; G. DON, 1831: 746, p.p.; WALP., 1853: 838. p.p. — Based on the misunderstanding that the *T. "peregrinum"* material in the Linnaean herbarium was homogeneous.

I c o n.: LAM., l.c.; BUCH., ll. cc. 219, 25. — Fig. 2, 4 e.

Geogr. distr.: Apparently collected only at Huánuco in northern Peru by JUSSIEU and WINTERFELDT (cf. above). A collection in K: "Peru — LOBB 14" might be of wild origin, as LOBB also collected in the same region.

SEEMANN's and MACBRIDE's annotations of wild *T. hayneanum* from southern Peru have proved to belong to different species (cf. above).

Revised material: *T. hayneanum*: BERNHARDI, garden collections, LOBB 14 — cf. above. — "DUCHESNE's species": LINN 481, 5—6; contemporaneous material in L and P.

Cult.: As pointed out above, *T. hayneanum* was cultivated in Europe during the second half of the 18th century, as well as in the middle of the 19th. It became early extinct in the gardens, but figured anyhow in garden literature at the beginning of our own century (ROBINSON 1907); it is, however, very problematic, if somebody now living person ever saw the plant growing.

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## A New Species of *Gnidia* (Thymelaeaceae) from South Africa

By BO PETERSON

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*Gnidia rubescens* B. Peterson, n. sp. Subgen. *Arthrosolen* (Mey.) Engl. *G. sericocephalae* (Meisn.) Gilg ex Engl. affinis, sed inter alia floribus rubescentibus, lobis calycis majoribus, ramulis et bracteis glabris differt.

**Descriptio holotypi:** Suffrutex 20—30 cm altus, rhizomate lignoso; caules erecti, graciles, parum ramosi, glabri. Folia alternata, brevissime petiolata, petiolo 1 mm longo; lamina anguste oblanceolata, apice acuta vel subacuta, 10—18 mm longa, 1.5—3 mm lata, glabra. Inflorescentia capitula terminalia, 10—15 mm in diam., c. 20—40-floribus; pedunculus 2—10 cm longus, glaber; bractee 8, ovatae, apice acutae vel acuminatae, 5—7 mm longae, 2—4 mm latae, glabrae. Flores demum flavi, paulatim rubescentes, 5-meri, pedicellati, pedicellis 1 mm longis, pilis setaceis villosis. Tubus calycis infundibuliformis, 7—10 mm longus (incl. lobi), 1/3 ab inferiori articulatus; supra articulationem breviter sed infra longe villosus, post deflorationem supra ovarium decidens; lobi late obovati vel suborbiculati, apice obtusi, intus glabri, extus sericei, 1—2 mm longi, 1—1.5 mm lati. Petala 0. Stamina 10, faucibus biserialiter inserta; antherae subsessiles, 3/4 mm longae, introrsae. Ovarium apice puberulum; stylo laterali, filiforme, 2—3 mm longo; stigma clavatum. Fructus siccus, pericarpio membranaceo, basi tubi persistenti inclusus. Semen unicum, 3 mm longum, testa crustacea, nitide nigra.

**Holotype:** MEEUSE n. 10196 (LD).

**Illustr.:** Fig. 1—2; LETTY 1962 pl. 114: 2.

**Habitat:** Lowveld vegetation. On dry, woody slopes, usually on gravelly soil. Altitude 300—1500 m.

**Distribution:** Northern and eastern Transvaal.

**Transvaal.** — Soutpansberg: 3 miles E of P.O. Wylliespoort, alt. ca 850 m, CODD, 26.1.1954, n. 8377 (LD, PRE). — Near Mara, about 18 miles from Louis Trichardt on Mara—Vivo road, MEEUSE, 3.4.1957, n. 10196 (LD, holotype; GB, PRE, isotypes). — In fruticet. pr. Klipdam, alt. 1530 m,



Fig. 1. Inflorescence of *Gnidia rubescens* B. Peterson ( $\times 3$ ).  
HAFSTRÖM & ACOCKS n. 986 (S).

SCHLECHTER, 14.2.1894, n. 4499 (S). — Letaba: Between Leydsdorp and Malati, HAFSTRÖM & ACOCKS, 22.10.1938, n. 986 (LD, PRE, S). — Malati, east of Leydsdorp, alt. ca 450 m, WALL, 22.10.1938, s.n. (GB, S). — Pilgrimsrest: Near Klaserie, RAUH & SCHLIEBEN, 8.9.1963, n. 9704 (S). — Kruger National Park, near Rabelais Dam, SCHLIEBEN, 5.2.1962, n. 9362 (S). — Nelspruit: Kruger National Park, 4 miles W Skukuza Camp, lowveld near river, alt. ca 300 m, ACOCKS, 13.1.1953, n. 16660 (LD, PRE). — Kruger National Park, Near Malelane, alt. ca 300 m, CODD, 13.5.1950, n. 6110 (K, LD, PRE). — Barberton: Kaapmuiden, foot of N. slopes, alt. ca 400 m, MOGG, 9.1.1938, s.n. (LD, PRE).

Shrub or subshrub up to 6 dm high with erect, slender branches from a woody rootstock. Unbranched or sparingly branched. Stems quite glabrous, usually terminated by an inflorescence. Leaves sparse above.



Fig. 2. Type specimen of *Gnidia rubescens* B. Peterson, n. sp. ( $\times 1/2$ ). MEEUSE n. 10196 (LD).



densely clustered towards the base, alternate, entire, narrowly oblanceolate, acute, glabrous, (9—)12—18(—23) mm long, 1.5—4 mm broad, shortly petiolated (1 mm). Inflorescence globose, 12—18 mm in diameter, ca 20—40 flowers; peduncle glabrous, 2—14 cm long. Involucral bracts (6—)8(—9), herbaceous green, ovate, acute(—acuminate), 5—8 mm long, 2—4 mm broad, glabrous or with a few scattered hairs on the lower side, occasionally sparsely ciliated. Flowers (4—)5-merous, at first yellow later rubescent, pedicel hairy, 1 mm long. Calyx, tube funnel-shaped, (7—)8—10(—12) mm long, circumscissile above the ovary, lower part with 3—4 mm long hairs, upper part with  $\pm 1$  mm long hairs. Calyx-lobes broadly obovate—suborbicular, obtuse, glabrous above, sericeous below, 1—2 mm long, 1—2 mm broad. Petals 0. Stamens 10 in 2 whorls, the upper shortly exserted; anthers sessile,  $\frac{3}{4}$  mm long. Ovary sparsely hairy at apex, style 2—3 mm long, stigma club-shaped. Seed glabrous, 3 mm long.

The new species is closely related to *G. sericocephala*, a species known from the Transvaal, Bechuanaland, Griqualand West, and the Oranje Free State. Although rather identical in habit and size, the two species are readily distinguished in nature and in herbarium specimens by the colour of the flowers, yellow in *G. sericocephala*, and yellow but very soon turning red orange in *G. rubescens*. The stems and peduncles are quite glabrous in *G. rubescens* but sericeous or pilose in *G. sericocephala*. The larger calyx-lobes of the new species is another difference.

*G. rubescens* grows on drier soil than *G. sericocephala*. It is locally rather frequent in open spaces among trees and usually more or less gregarious.

In her skilful work Wild Flowers of the Transvaal (Pretoria 1962). CYTHNA LETTY has reproduced an excellent colour plate (114:2) of *G. rubescens* under the name of *Arthrosolen* sp.

The specific epithet chosen refers to the colour of the flowers becoming red at the time of the anthesis.

## An Analysis of Variation of Leaf Dimensions in *Becium homblei* (De Wild.) Duvign. & Plancke and *Becium obovatum* (E. Mey.) N. E. Br.

By H. WILD<sup>1</sup> and A. HEYTING<sup>2</sup>

### Introduction

Recent investigations into endemism on the serpentines of the Great Dyke of Rhodesia (WILD 1965) and the conclusion that endemics probably evolved there through biotype depletion of once widely distributed species not confined to serpentines, as has been described for American conditions by STEBBINS (1942), has drawn attention to the interesting case of *Becium homblei* (De Wild.) Duvign. & Plancke. This plant is known as the "Copper Plant" since it invariably occurs on soils with high copper concentration in the surface layers. It is found on copper bearing soils in the Congo (Katanga), Zambia (Copperbelt) and Rhodesia. Sometimes it appears on quite small areas, e.g. Molly South Hill at Mangula, Rhodesia, which is only a few acres in area. To a limited extent the plant has been used for the discovery of unexploited copper deposits. The Copperbelt of Zambia is some hundreds of miles away from the copper outcrops of Mangula, etc., in Rhodesia and a casual examination of this situation might lead one to wonder if the same species, *B. homblei*, had not evolved independently at a number of sites, since we can scarcely assume that there might once have been a continuous layer of copper bearing soils covering most of Zambia and Rhodesia thus allowing for a continuous distribution of *B. homblei* in the past. This rather startling hypothesis soon gives way on more mature thought to the conclusion that we probably have a situation where *B. homblei* once had a more continuous type of

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distribution and survived only on copper outcrops as a result of biotype depletion, as seems to be the case with some Rhodesian serpentine species. If this is so then we might expect that, owing to this biotype depletion, the species would show a lack of variation in its morphological and other characters as compared with the species as it existed before its adaptation and restriction to copper bearing soils. As in that case the remaining biotypes would now be extinct, a direct comparison is impossible. However, another member of the same genus, *B. obovatum* (E. Mey.) N.E. Br., closely related to *B. homblei* and probably sharing a common ancestry with it, does occur throughout the area of distribution of *B. homblei*, and even further afield, so it may have some relevance to this particular evolutionary situation to examine and compare the degree of variability of selected characters within the one species with the degree of variability of the same characters within the other.

Both species are similar in habit, being perennials rarely exceeding 0.6 m. tall. However, *B. homblei* is more bushy and has more vertically ascending branches whilst *B. obovatum* is more spreading. The leaves are in both cases from narrowly obovate to oblong-elliptic or narrowly obovate-oblong but differ in that those of *B. homblei* are a paler green when fresh and have their primary nerves forming a narrower angle with the midrib and run more nearly parallel with the margins. In the flower there are distinct differences in the lobing of the corolla and *B. homblei* has the sides of the calyx-tube lanate rather than puberulent, especially anteriorly.

Leaf-length and leaf-width were chosen as two convenient characters for this investigation. They are both easily obtained and amenable to statistical analysis.

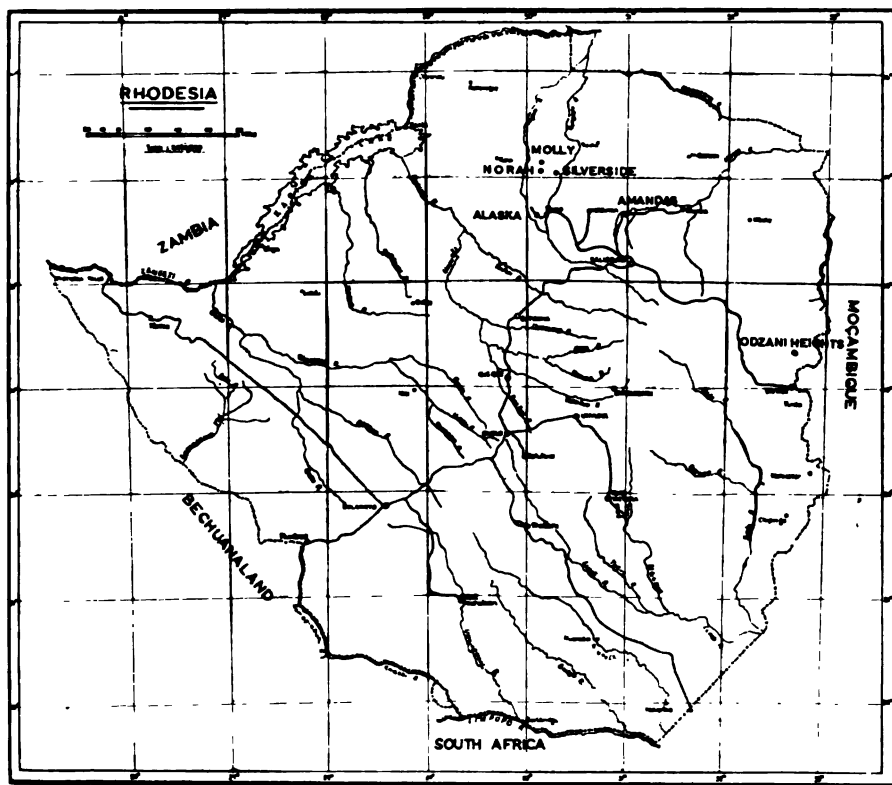
### Material

*Becium homblei* was investigated at four sites and *Becium obovatum* at four different sites. At each of these eight sites, 250 leaves were selected at random and their lengths and breadths were measured (see Map).

The location of the sites was as follows:

#### *Becium homblei*

- Site H 1 — Mangula, Molly South Hill
- Site H 2 — Mangula, Norah Mine
- Site H 3 — Alaska Mine
- Site H 4 — Silverside Mine



*Becium obovatum*

Site O 1 — Umtali District, Odzani Heights

Site O 2 — Adjacent to Norah Mine

Site O 3 — Amandas, near Concession

Site O 4 — Adjacent to Silverside Mine

**Analysis**

The following statistical model for leaf length was postulated:

$$l_{ijk} = l + s_i + l_{ij} + e_{ijk},$$

where:  $l_{ijk}$  is the length of the  $k^{\text{th}}$  leaf selected at the  $j^{\text{th}}$  site of the  $i^{\text{th}}$  species,  
 $l$  is the grand mean,  
 $s_i$  is the effect common to all leaves of the  $i^{\text{th}}$  species,  
 $l_{ij}$  is the effect common to all leaves at the  $j^{\text{th}}$  site of the  $i^{\text{th}}$  species,  
 $e_{ijk}$  is a random component, normally independently distributed with zero mean and variance  $\sigma^2_{ij}$ .

Table I. Leaf Lengths

Set	Site	Mean leaf length	$s^2_{ij}$	$r_{ij}$
1	H 1	59.07	52.647	.674***
	H 2	62.14	65.430	.067 (N.S.)
	H 3	54.58	31.884	.199**
	H 4	46.73	32.952	— 090 (N.S.)
2	O 1	74.96	154.265	.293***
	O 2	75.18	146.956	.202**
	O 3	71.00	79.402	.274***
	O 4	58.08	76.892	.606***

Note: \*\* and \*\*\* indicate that  $\rho_{ij}$  is significantly different from zero at  $P \leq .01$  and  $P \leq .001$  respectively. (N.S.) indicates that  $\rho_{ij}$  is not significantly different from zero at  $P \leq .05$ .

The species index  $i$  is coded  $H$  or  $O$ , corresponding to *B. homblei* and *B. obovatum* respectively. The site index  $j$  ranges over the values 1—4, corresponding to the site list above.

The model for leaf-width is similar to that for leaf-length. The existence of a correlation coefficient between leaf-length and leaf-width was postulated. The notation chosen for this correlation coefficient at the  $j$ th site of the  $i$ th species is  $\rho_{ij}$ .

Estimates  $s^2_{ij}$  of the  $\sigma^2_{ij}$  were obtained for both leaf-length and leaf-width. These, together with estimates of the mean leaf-length and leaf-width for each species at each site are given in Tables I and II. Estimates  $r_{ij}$  of the  $\rho_{ij}$  are given in Table I.

For purposes of brevity, the four variances or estimates of variance of leaf-length corresponding to each of the two species will henceforth be referred to as "sets". Similarly, two sets are defined for leaf-width.

Using the statistical model and the information contained in Tables I and II, a number of questions which are relevant to this investigation were answered.

Table II. Leaf Widths

Set	Site	Mean leaf width	$s^2_{ij}$
3	H 1	12.72	4.032
	H 2	14.72	10.370
	H 3	12.87	2.695
	H 4	11.30	1.791
4	O 1	19.18	26.928
	O 2	10.66	3.426
	O 3	13.31	3.687
	O 4	9.53	3.695

Table III

Type of Measurement	Species	Value of $\chi^2$ (3 d.f.)	Probability of observing the set of $s^2_{ij}$ under the null hypothesis
Leaf length	<i>B. homblei</i>	41.588	<.001
	<i>B. obovatum</i>	52.920	<.001
Leaf width	<i>B. homblei</i>	224.460	<.001
	<i>B. obovatum</i>	458.437	<.001

**Question 1: Does the variance of leaf-length and/or leaf-width vary from site to site for a species?**

For each set the null hypothesis, that the four variances are the same, was tested by applying Bartlett's test of homogeneity of variance to the four  $s^2_{ij}$ . The results of these tests are given in Table III. These results lead, for each set, to the rejection of the null hypothesis. The alternative hypothesis, that there are differences between the variances within each set, may therefore be adopted. In addition, all possible pairs of variances within each set were tested for differences by the F test. The results of these tests are given in Tables I and II. If two  $s^2_{ij}$  within a set are covered by a continuous vertical line, the corresponding  $\sigma^2_{ij}$  do not differ significantly at  $P \leq .05$ , while all pairs within a set which are not covered in this way do differ significantly at  $P \leq .05$ .

**Question 2: Is leaf-length and/or leaf-width of one of the two species more variable than of the other?**

Because the variances of leaf-length and leaf-width within each of the four sets are heterogeneous, it is not meaningful to obtain a pooled estimate of variance for each set and to make comparisons between such estimates. For this reason each of the  $s^2_{ij}$  in set 1 was tested, by means of the F test, against each of the  $s^2_{ij}$  in set 2 and similarly, each of the  $s^2_{ij}$  in set 3 was tested against each of the  $s^2_{ij}$  in set 4. The results of these tests are as follows:

(a) *Leaf-length*

Each of the  $s^2_{Oj}$  is greater than every one of the  $s^2_{Hj}$  and except for the F ratios  $s^2_{O4}/s^2_{H2}=1.18$  and  $s^2_{O8}/s^2_{H2}=1.21$ , both of which are not significant at  $P \leq .05$ , the results of all tests are significant at  $P \leq .01$ . As far as the sites in this investigation are concerned, it may therefore be safely stated that the leaf-length of *B. obovatum* is, on the whole, more variable than that of *B. homblei*.

(b) *Leaf-width*

The results of the series of F tests for leaf-width gave a more complex picture. The leaf-width at site O1 was found to have a larger variance than the leaf-widths at sites H1, H2, H3 and H4 (all tests significant at  $P \leq .01$ ). There was no significant difference (at  $P \leq .05$ ) between the variances of

Table IV

Site	Mean leaf length	Site	Mean leaf length	Site	Mean leaf width	Site	Mean leaf width
H 2	62.140	O 2	75.184	H 2	14.720	O 1	19.180
H 1	59.072	O 1	74.960	H 3	12.868	O 3	13.312
H 3	54.580	O 3	70.996	H 1	12.724	O 2	10.660
H 4	46.728	O 4	58.076	H 4	11.300	O 4	9.528

the leaf-widths at sites O 2, O 3 and O 4 and the variance of the leaf-width at site H 1. The variances of the leaf-widths at sites O 2, O 3 and O 4 were found to be significantly greater than the variances at sites H 3 (all tests significant at  $P \leq .05$ ) and H 4 (all tests significant at  $P \leq .01$ ). The variance of the leaf-width at site H 2 was found to be larger than the corresponding variances at sites O 2, O 3 and O 4 (tests all significant at  $P \leq .01$ ). Except for the large variance at site H 2 the results for leaf-width are similar to those for leaf-length. However, because of the small number of sites investigated, it cannot be confidently stated that the leaf-width of *B. obovatum* is, on the whole, more variable than that of *B. homblei*.

**Question 3:** *Are there differences between the mean leaf-lengths and/or leaf-widths over the four sites of a species?*

A consequence of the answer to question 1, that there are differences between the variances of both leaf-length and leaf-width within each of the four sets, is that no exact testing procedure exists to test all comparisons among the mean leaf-lengths/leaf-widths within a set. An approximate test was used here. It is an adapted version of the test described in section 10.6 of the 5th edition of G. W. SNEDECOR's "Statistical Methods".

The test consists of ranking the four observed means within a set in decreasing order of magnitude. For each of the six possible comparisons between two means, the quantity

$$D_{(ij)(ik)} = (Q_a / \sqrt{2}) \sqrt{(s_{ij}^2 + s_{ik}^2) / 250}$$

is evaluated.  $D_{(ij)(ik)}$  is the smallest difference between the  $j^{\text{th}}$  and the  $k^{\text{th}}$  ranked means ( $j < k$ ) of the  $i^{\text{th}}$  species which is significant at  $P \leq 0.05$ . The appropriate value of  $Q_a$  is found in table 10.6.1 of SNEDECOR's book, for  $a = k - j + 1$  and the number of degrees of freedom equal to 249.

The results of these tests are given in Table IV. Only if two means within a set are covered by a continuous vertical line do the corresponding population means not differ significantly at  $P \leq .05$ .

**Question 4:** *Is it possible to deduce something about the leaf-shape of the two species from the estimates of the correlation coefficients between leaf-length and leaf-width for the different sites?*

Estimates  $r_{ij}$  of the  $\rho_{ij}$  are given in Table I. For each site, the hypothesis  $\rho_{ij} = 0$  was tested against the alternative hypothesis  $\rho_{ij} \neq 0$ . The results of these tests appear in the same table.

Table V

Site	H 1	O 4	O 1	O 3	O 2	H 3	H 2	H 4
$r_{ij}$	.674	.606	.293	.274	.202	.199	.067	— .090
test at $P \leq .01$								
test at $P \leq .05$								

The four  $r_{ij}$  for both *B. homblei* and *B. obovatum* were tested for heterogeneity by means of the appropriate  $\chi^2$  test. The same test was performed on all eight  $r_{ij}$  together. The three tests all gave a result of  $P \leq .001$ , indicating that the true correlation coefficients for the different sites are not the same. This means that there is no really satisfactory method of testing whether the correlation is generally stronger for one species than for the other. Tests for differences between individual pairs were carried out at  $P \leq .01$  and  $P \leq .05$ . The results appear in Table V. Significant differences are indicated as before.

### Discussion

1. Within every site, the variances of leaf-length and leaf-width each consist of a component due to genotypic and another due to environmental effects. If the fact that *B. homblei* occurs only on copper outcrops is the result of biotype depletion then, on the assumption that both species had the same genotypic variance of leaf-length and leaf-width before the operation of biotype depletion, it follows that one may expect the genotypic variances of leaf-length and leaf-width of *B. homblei* at the different sites of that species to be smaller than those of *B. obovatum*. If it is found that the genotypic variances follow these trends, then this lends support to the hypothesis that *B. homblei* occurs only on copper outcrops as a result of the operation of biotype depletion on a distribution which was once much more continuous.

The adopted sampling method does not permit the estimation of the environmental and genotypic components of variance. The statistical analysis of the data was therefore based on the phenotypic variances, hoping that the environmental components did not differ sufficiently over the eight sites to obscure differences between the genotypic components.

The results of the statistical analysis certainly do not contradict the hypothesis that biotype depletion is responsible for the present distribution of *B. homblei*. Except for the large variance of the leaf-width of *B. homblei* at the Norah Mine site at Mangula, the magnitudes of the variances of both leaf-width and leaf-length of the two species agree well with this hypothesis (refer to Question 2).



2. It is shown under question 1 that the phenotypic variances of both leaf-length and leaf-width differ over the four sites of each species. Question 3 provides evidence that the mean leaf-lengths at the four sites of each species are different. The same applies to mean leaf-widths. Unless these phenomena are ascribed solely to environmental factors, some interesting speculations can be made about the reasons for them.

In the case of *B. homblei* the argument that, due to spatial isolation, there is a beginning of the development of endemic forms on the different "islands" of copper outcrops and/or that the rate of biotype depletion has not been the same at all sites, would provide a logical explanation.

The same reasoning cannot hold true for *B. obovatum* since this species is continuously distributed throughout the area and is extremely common. Some evidence has already been found for the existence of more numerous biotypes in this species than in *B. homblei* (see 1 above). The existence of this large number of biotypes in *B. obovatum* is obvious to any field botanist with experience of the plant. The species seems to consist of numerous forms but the number is so large that no taxonomist has so far attempted to bring any sort of order out of this most involved pattern. It seems reasonable however to expect that no single small area (such as a site in this investigation) contains a representative sample of all these forms. Differences in phenotypic variances, mean leaf-lengths and mean leaf-widths between the sites of each species could thus be, at least partly, the result of differences between biotypes at these sites.

3. If gene loss associated with biotype depletion leads to a more uniformly shaped leaf, regardless of leaf-size, then a stronger correlation between leaf-length and leaf-width may be expected after the operation of biotype depletion than before. Situations are known however, where gene depletion has led to a decreased correlation between certain plant characteristics. It is doubtful, therefore, whether solid evidence for or against the hypothesis, that the distribution of *B. homblei* is the result of biotype depletion, can be obtained from an investigation of the phenotypic correlation coefficients between leaf-length and leaf-width. All the same, such an investigation was carried out in question 4, merely to determine whether a particular trend could be observed. If, of course, it had been found that leaf-length and width are strongly correlated at all sites of both species, this would have meant that, in future investigations, the recording

of one of these measurements in addition to the other might be expected to yield very little extra information.

As it proves, no clearcut picture emerges from question 4. The same arguments as were used in 2 above, to explain heterogeneity of variances and differences between mean leaf-lengths and widths, may be used to explain the observed heterogeneity of correlation coefficients between the different sites in so far as this is not accounted for by environmental factors.

4. Finally, because of the imperfections of the sampling scheme, these investigations are necessarily of a preliminary nature. It is hoped that future investigations, adopting a method of sampling which will allow for the estimation of the genotypic and environmental components of variance, will support the above findings and eliminate those aspects of the problem on which speculations were unavoidable in this paper.

### Summary

A statistical analysis of the variation of leaf-length and leaf-width in *Becium homblei* (De Wild.) Duvign. & Plancke, a species confined to copper bearing soils, and *B. obovatum* (E. Mey.) N.E. Br., a variable species with a wide distribution on many soil types, shows that leaf-length and leaf-width are, on the whole, more variable in *B. obovatum* than in *B. homblei*. If certain assumptions are accepted, this provides supporting evidence for the theory that *B. homblei* has evolved from a once more widely distributed species of which a reduced number of biotypes has survived on copper outcrops whilst the majority of biotypes which used to grow on other soil types has become extinct.

Secondly, there are significant differences of variability, leaf-length and leaf-width between sites of *B. homblei* geographically segregated from each other. This may indicate how vicarious species and new geographically isolated endemics may develop and shows perhaps that this process is taking place in *B. homblei*.

On the whole there are also significant differences in variability, leaf-length and leaf-width between sites of *B. obovatum* but presumably for different reasons, namely that, as is already well known from general field evidence, this is an extremely variable species with numerous forms. These, however, are not distinctly geographically segregated and so far have defied logical analysis by orthodox taxonomic methods.

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## **Silene conica, en senkommen medborgare i Skånes flora**

AV HENNING WEIMARCK

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Genom människans verksamhet kommer ständigt växter, främst genom frukter och frön, in i vårt land. De flesta av dessa främmande växter är obeständiga hos oss. I regel stannar de blott över en vegetationsperiod eller i gynnsamma fall några få år. Frukterna når ofta ej fram till mognad, och arten är därmed dömd till snar undergång, såvida den inte förmår hålla sig kvar eller sprida sig genom vegetativ förökning. Vanligt är också, att växten inte kan konkurrera med den inhemska floran. Främlingen har svårt att etablera sig i naturlig miljö, där växttäcket är slutet. Hamnar, fabriksomter och avfallsplatser, dvs. lokaler med labila miljöförhållanden, erbjuder däremot möjlighet för kolonisering. Den mest bekanta och på främmande växter rikaste lokalen i Skåne har varit vid yllefabriken i Lackalänga, vars »ullflora» är mycket uppmärksammas. Åtskilliga hundra arter har under årens lopp noterats där.

I många fall har emellertid den inkomna växten lyckats tränga in i naturlig vegetation. Har detta skett för länge sedan — låt oss säga under medeltiden eller tidigare — är det svårt eller omöjligt att spåra ankomsttider eller invandringsvägar. Man har måhända ingen anledning misstänka, att växten ej är ursprunglig eller att den inte kommit in med »egna» spridningsmedel.

I återigen andra fall vet vi bestämt besked: växten härstammar från m. el. m. avlägsna länder och har kommit in i sen tid, avsiktligt eller oavsiktligt genom människans medverkan. Bland sådana nu vida spridda arter må här blott några nämnas.

*Erigeron canadense* — funnen första gången i Skåne 1828 i Gussnava i Skårby,

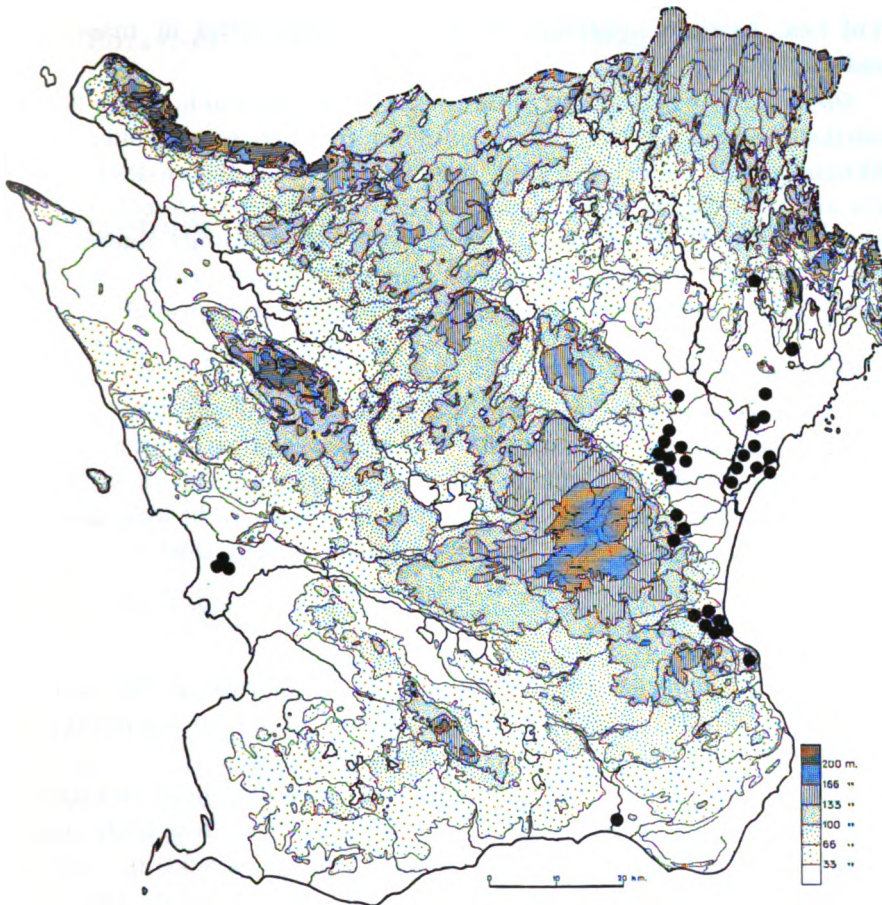


Fig. 1. Den nu aktuella utbredningen av *Silene conica* i Skåne.

*Senecio vernalis* — 1864 i Fågelsång,  
*Impatiens parviflora* och *Matricaria discoidea* — 1867 i Lund,  
*Elodea canadensis* — 1883 i Alnarp,  
*Silene conica* — 1894 i Vitaby,  
*Epilobium adenocaulon* — 1944 i Våmb

*Erigeron canadense*, *Senecio vernalis* och *Silene conica* hör i Skåne hemma på odlad mark och har naturaliserats i stäppartade torrängar, en miljö, som är starkt kulturbetingad. Att den stäppartade torrängen blivit hemvist för främmande element, sammanhänger med att växttäcket ofta ej är slutet och därför utrymme lämnas för nya komponenter. Detta är särskilt fallet på solexponerade sluttningar och branter.

Vid t.ex. Lyngsjö uppträder *Silene conica* åtm. vissa år massvis på sådana lokaler.

*Silene conica* upptäcktes 1894 av OTTO R. HOLMBERG. Den har nu talrika förekomster i ö. Skånes sandområden och förekommer även i liknande miljö i s. och v. Skåne (karta fig. 1). Den överensstämmer till sin areal i ö. Skåne mycket med *Anthericum*-arterna, *Dianthus arena-rius*, *Festuca polesica*, *Minuartia viscosa* och åtskilliga andra, vilka betraktas som inhemska. Om man inte kände *Silene conicas* historia, skulle man vara benägen att uppfatta även den som ursprunglig i Skåne.

HOLMBERG (Bot. notiser 1910) skriver om sitt fynd:

»*Silene conoidea* L. vid Torup i Hvitaby sn i mängd dels i klöfvervallar, dels vid vägkanter och här och der på sandiga betesmarker ned mot hafvet (1894)». Då växten redan vid upptäckten fått så stor spridning, är det väl troligt, att den kommit in i denna trakt åtm. några år tidigare. I Danmark anträffades den första gången 1890.

1910 (i Bot. notiser) korrigerar NEUMAN bestämningen till *S. conica* och skriver:

»Växten, som synes tillhöra Sydeuropa, har spridit sig till de flesta europeiska länder och har, enligt hvad nu är mig bekant, sin nordligaste utpost här i Skåne, där den är fullt acklimatiserad . . .».

Sedan *Silene conica* väl blivit uppmärksammas genom HOLMBERGS och NEUMANS uppsatser, upptäcktes den snart inom flera andra områden. Så vitt jag kunnat finna i litteratur och med stöd av herbarie-exemplar i våra offentliga samlingar har arten följande upptäckts-historia i Skåne. För var socken har det första fyndet angivits.

Vitaby OTTO R. HOLMBERG 1894  
 Ravlunda C. G. G. THEORIN 1903  
 Brösarp C. G. G. THEORIN 1907  
 Degeberga FR. R. AULIN 1908  
 Lyngsjö OVE ALMBORN 1937  
 Rinkaby GÜSTA ILIEN 1939  
 Kiaby TORSTEN HÅKANSSON 1943  
 Oppmanna OLOF ANDERSSON 1943  
 Åhus TH. LANGE 1946  
 Fjälkinge GUNVOR WIDEHOLT 1946

Hofterup och V. Karaby ELLA  
 JOHANSSON 1948  
 S. Mellby HENNING WEIMARCK 1948  
 Skepparslöv UNO HOLMBERG 1951  
 Vä och Ö. Vram UNO HOLMBERG 1954  
 St. Köpinge HENRIK JOHANSSON 1962  
 Ö. Sönnarslöv M. & S. ROMÉE 1962  
 Everöd och Gårds Köpinge ARNE  
 HOLMQVIST 1964

De pågående fältundersökningarna för nästa upplaga av Skånes Flora kommer säkerligen att resultera i ytterligare fynd av *Silene conica*, som sannolikt ännu vidgar sin areal.

## **Sphagnum angermanicum Found in Northern Dalarna, Sweden**

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In a recent paper (1965) W. MAASS reports several finds of *Sphagnum angermanicum* Melin in southern Norway in addition to MELIN's (1917, 1919) original locality in Ångermanland, Sweden, which he re-visited, finding the species still to be growing there. Furthermore, MAASS has discovered this species within an extensive area in easternmost N. America (MAASS, in prep.). During his visit to Uppsala in 1962, he told me about his discoveries and also kindly put some material at my disposal.

MAASS (1965, p. 342) points at the large distributional gap between South Norway and Ångermanland and anticipates that the species will be found in between. Before this prophecy was in the press, it was indeed fulfilled, for last summer, I was lucky enough to find *S. angermanicum* half-way between MELIN's locality and the nearest Norwegian one.

Unfortunately I was too late in sending material to Dr. MAASS and in learning that his article was being printed to have the find included in his list (p. 338) of Scandinavian localities; however he kindly confirmed the determination. The material is typical in all respects but probably owing to the somewhat early season the moss had not developed any pink hue, being whitish green all over. The reported coloration through a reddish pigment seems thus not only to be weak but also unusually late in season in this species, the other red *Acutifolia* and *S. magellanicum* overcoming the early vernal (usually only partial) discoloration much earlier. Light was abundant on the two spots where *S. angermanicum* was found, and even *S. girgensohnii* was quite brownish in one of them, looking rather unfamiliar, as one is most used to see the latter species in shady habitats.

The locality is situated in the province of Dalarna, Orsa parish, 40 km due north of the church and 4.5 km WSW of Älvho railway station, near point 416 on the topographical map 108 Storejen: H. SJÖRS June 24, 1965. This is near the northern border of Orsa, where this parish abuts on the chapelry of Hamra (the so-called Orsa finnmark), belonging to the parish of Los. The Ore River (a tributary of the Dalälven) constitutes the boundary between Orsa and Hamra. This river is now being dammed to serve in two power plants called Vässinkoski and Noppikoski (note the Finnish place-names: this is an area of scattered settlement by Finns during the 17th century). Above the rapids at Vässinkoski the river traverses a wide sandplain at about 420 m, soon to be submerged by a large artificial lake. The sandplain is poor in species, being originally covered by lichen pine forest now cut and burnt-over, but somewhat richer vegetations was found on its edges<sup>1</sup> where it borders on slopes of coarse till. However the prevailing rock is porphyry (except farther east where a broad diabase vein occurs), and these porphyry areas are notorious for their nutritional poverty.

On the plain the Ore River receives two right-hand tributaries, the Bäverån and the Griffelån, and between the three rivers, there is a mire of about  $1\frac{1}{2}$  sq. km. Most of this mire is poor fen (DU RIETZ 1949, etc.). but some parts with a greater flow of minerotrophic (DU RIETZ 1954) water rather have "intermediate" (SJÖRS 1952) fen vegetation, or at least a few indicator species of less acid conditions.

*Sphagnum angermanicum* was found in not too poor fen vegetation on two spots about 200 m apart. The first was close north of the brook Griffelån, on an area with very scattered small birches not far from the wooded riverside fen. The "mire margin" component in the vegetation was not strong except for the unexpected occurrence of much *Sphagnum girgensohnii* (see above) and the only finds of *S. aongstroemii* and *Peucedanum palustre* on the future lake bottom. Also an *Orchis* of *traunsteineri* affinity can be mentioned (it was found in one more place on this mire): it is not at all an indicator of lime in these regions. *S. angermanicum* was quite abundant over a small area.

<sup>1</sup> Quite unexpectedly, an aberrant area of only about 100 sq.m of true rich fen was found on the western edge near the brook Bäverån; here several typical rich fen mosses were seen, including *Meesia tristicha* which has not earlier been reported from Dalarna with full certainty (see ALBERTSON 1949, pp. 180, 188). This place had the highest conductivity ( $\kappa_{20}=24 \cdot 10^{-6}$ ) found in the Vässinkoski area, and a water pH about 6, but still is much inferior in these respects to a truly calcareous fen.

forming low cushions only about 1 dm above normal water level, and it could be collected in great quantity.

The other find-place was treeless and much wetter, being situated on the edge of a large, pool-like flark (mud-bottom area), but the way in which *S. angermanicum* grew was similar. A list of the species on the two localities is given:

<i>Betula pubescens</i>	1	<i>Eriophorum angustifolium</i>	1.2
<i>Salix lapponum</i>	1	<i>Molinia coerulea</i>	2
<i>Andromeda polifolia</i>	1.2	<i>Scheuchzeria palustris</i>	2
<i>Betula nana</i>	1.2	<i>Trichophorum alpinum</i>	2
<i>Vaccinium oxycoccus</i>	1.2	— <i>caespitosum</i>	2
<i>Drosera anglica</i>	2	<i>Sphagnum angermanicum</i>	1.2
— <i>rotundifolia</i>	2	— <i>aongstroemii</i>	1
<i>Equisetum fluviatile</i>	2	— <i>apiculatum</i>	1
<i>Menyanthes trifoliata</i>	2	— <i>girsensohnii</i>	1
<i>Orchis cf. traunsteineri</i>	1	— <i>inundatum</i>	1
<i>Pedicularis palustris</i>	1	— <i>lindbergii</i>	1
<i>Peucedanum palustre</i>	1	— <i>magellanicum</i>	1
<i>Pinguicula vulgaris</i>	2	— <i>papillosum</i>	1.2
<i>Potentilla erecta</i>	1.2	— <i>parvifolium</i>	1
<i>Selaginella selaginoides</i>	2	— <i>pulchrum</i>	1.2
<i>Succisa pratensis</i>	2	— <i>robustum</i>	1
<i>Trientalis europaea</i>	1.2	— <i>rubellum</i>	1
<i>Utricularia intermedia</i>	1	— <i>subfulvum</i>	2
<i>Carex chordorrhiza</i>	1.2	— <i>subsecundum</i>	1
— <i>dioeca</i>	1.2	<i>Aulacomnium palustre</i>	1
— <i>lasiocarpa</i>	1.2	<i>Calliergon stramineum</i>	1
— <i>limosa</i>	1.2	<i>Drepanocladus badius</i>	1.2
— <i>livida</i>	2	— <i>purpurascens</i>	1
— <i>magellanica</i>	1	<i>Polytrichum commune</i>	1
— <i>rostrata</i>	1.2	<i>Scapania paludicola</i>	1

The electrolyte content of the fen water was exceptionally low, the residual conductivity (after the estimated conductivity of hydrogen ions had been subtracted) being below  $6 \cdot 10^{-6}$  in the first and about  $9 \cdot 10^{-6}$  in the second locality. There is a slight uncertainty due to the pH values which turned out not to be fully reliable, because of which they had to be discarded (neither locality was really strongly acid, however, with water pH almost certainly above 5).

It is unfortunate that the rather ample occurrence at Vässinkoski of a species so rare in Europe (it has not been found outside Scandinavia) will be destroyed very soon, during this or next year. Its discovery on its second certain Swedish station involves a strong argument that every natural area, however dull according to expectation, that is to be sacri-



ficed for industrial or other development, should be searched carefully by field biologists.

MAASS (1965 p. 342) speculates on glacial survival and post-glacial migration of *S. angermanicum* in Europe. Such isolated occurrence in heavily glaciated country must be the result of post-glacial migration, and not a relic. We now know that *S. angermanicum* belongs to the Atlantic element in *Sphagnum* which consists of either exclusively American or amphi-Atlantic species and must be chiefly of American origin (however, some of the species occur in the Pacific area, too). We have to assume a trans-Atlantic eastbound journey for each of the amphi-Atlantic *Sphagnum* species but we shall have little chance to know about the time of their arrival in Europe, although there is evidence that *S. imbricatum* and *S. auriculatum* were present in SW. Sweden in the early Post-glacial (OLAUSSEN 1957, pp. 37 and 39).

#### Acknowledgements

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## Two New Compositae from Southern Africa

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*Othonna brandbergensis* B. Nord. sp. nov.

Holotype: NORDENSTAM 2780 (LD).

Illustr.: Figs. 1, 2.

Frutex erectus ramosus robustus glaber 1—2 m altus. Folia alterna erecto-patentia, subglaucous, irregulariter pinnatipartita, lobis suboppositis vel alternis, inaequalibus, linearibus, integris vel lobatis, acutis—acuminatis. Capitula corymbosa, pedunculo erecto, robusto, 2—3 dm longo. Bracteae involucri 5, oblongae. Flores radii 5, ligulati, flavi. Setae pappi copiosae, albae et suffusculae, serrulatae, persistentes, post anthesin elongatae. Achaenium 4—5 mm longum, dense albo-villosum. Flores disci c. 30—40. Stylus sterilis, apice clavatus, simplex. Setae pappi albae, caducae. Ovarium anguste cylindricum, glabrum, 5-striatum.

A vigorous, erect, branching, glabrous shrub, 1—2 m high. Stems and branches with light brown—greyish cortex, basally up to 5 cm in diam., leafy towards the tips, becoming naked below. Leaves erecto-patent, 1—1.5 dm long, pinnatipartite with linear flattened acute—acuminate 1—3 mm wide segments, glabrous, subglaucous and somewhat tough; lobes subopposite or alternate, forked or lobed, sometimes rather irregularly with  $\pm$  flexuous lobes, or (some) entire. Peduncles terminal, solitary, many-headed, laxly corymbose, erect, terete, normally 2—3 dm long; upper bracts small, subulate. Involucral bracts 5, oblong-obovate—narrowly oblong, 6—8 mm long, 3.5—5 mm wide, faintly many-nerved, obtuse—subacute, thin-margined, coriaceous and connate at the base. Receptacle slightly convex, honey-combed, glabrous. Ray-florets 5. Tube c. 4 mm long, cylindrical. Lamina yellow, oblong—elliptic-oblong, 7—8 mm long, 4—5 mm wide, 5-nerved, truncate and denticulate at the apex. Style terete; lobes flattened, c. 2 mm long, densely puberulous on the outsides, with obtuse—

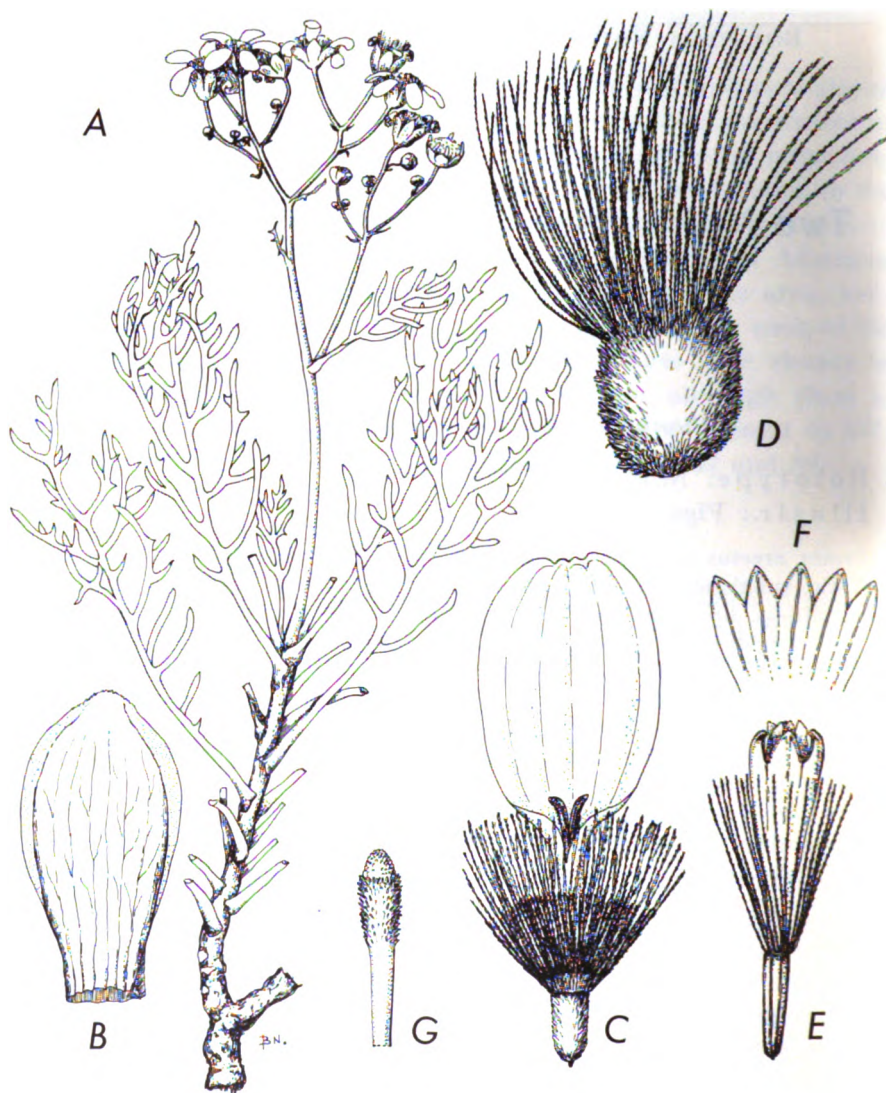


Fig. 1. *Othonna brandbergensis* B. Nord. — Drawing of the holotype, NORDENSTAM 2780 (LD). — A: Portion of plant,  $\times 1/2$ . — B: Involucral bract,  $\times 5$ . — C: Ray-floret,  $\times 5$ . — D: Achene,  $\times 5$ . — E: Disc-floret,  $\times 5$ . — F: Corolla of disc-floret, laid open,  $\times 5$ . — G: Style of disc-floret,  $\times 10$ . — Del. auct.

rounded tips. Pappus bristles copious, light brownish with white tips (the white portion c. 2 mm long), serrulate, straight, persistent, c. 5 mm long during anthesis, elongating to the double in post-anthesis.



Fig. 2. *Othonna brandbergensis* B. Nord. on the Brandberg, Königstein area, c. 2200 m. In the background (left) a small tree of *Cyphostemma* (*Cissus*) *crameriana*. — Photo author 31.V.1963.

**Achene** elliptic-oblong or oblong-obovate, 4—5 mm long, 3—4 mm wide, densely white-villous. **Disc-florets** c. 30—40. **Corolla** tubular, widening above, c. 6 mm long; lobes deltoid, c. 1 mm long, subcucullate, acute. **Style** unbranched, sterile, apically thickened, puberulous, with a rounded or bluntly conical papillate tip. **Anthers** 2.2—2.5 mm long incl. the ovate acute appendage. **Pappus** bristles c. 30—40, c. 5 mm long, white, caducous. **Ovary** narrowly cylindrical, 2.5—3 mm long, glabrous, with 5 longitudinal veins or ribs.

**Flowering period:** Flowering specimens collected in May. Probably flowering at irregular times after rains.

**Chromosome number:**  $2n=20$ . (Determined on root tip mitoses, fixative a modified Navashin-Karpeschenko, paraffin method, sections 10  $\mu$ , stain crystal violet.)

**South West Africa.** Omaruru District: Brandberg, E. of Königstein, stony slopes towards Tsisab Valley, c. 1850 m, 29.V.1963, NORDENSTAM 2780 (LD); Brandberg, Orabeswand, c. 2000 m, 3.IV.1964, NORDENSTAM 3639 (LD).

This species the author had the pleasure to find on the Brandberg in 1963 and at once recognized it as a new *Othonna*, quite distinct from the other South West African members of that genus (for a recent

account of these, see MERXMÜLLER 1965). The shrubby non-succulent habit and the corymbose inflorescence indicate a relationship to geographically remote South African species, e.g., *O. pavonia* E. Mey. ex DC. from north-eastern Cape.

*O. brandbergensis* is a plant characteristic of the upper Brandberg, occurring in rocky (all granite) places from about 1800 m almost to the top of Königstein (2585 m). In 1963, a year with remarkably good rains, the bushy plant was very conspicuous with abundant foliage and richly flowering branches. The succeeding dry summer yielded only poorly developed specimens practically without flowerheads.

Plants raised from seeds (collected in 1963) and grown for two years in the Botanical Garden of Lund are only 2—3 dm high, with stems about an inch thick near the base and with scanty foliage. No doubt the plants would grow even slower in nature, and specimens as tall as a man must be of considerable age. The stems of the seedlings are rather quickly thickened, however, probably as a protection against loss of water.

*Helipterum montanum* B. Nord. sp. nov.

**Holotype:** ESTERHUYSEN 26745 (BOL).

**Illustr.:** Fig. 3.

Suffrutex 1—3 dm altus, a basi ramosus; rami adscendentes, dense foliati, tomentosi. Folia anguste oblonga—oblongo-obovata, obtusa—subacuta, dense et adpresse tomentosa. Capitula solitaria, terminalia, saepe paullum cernua, campanulata, c. 2 cm diametro. Squamae involucris imbricatae, albae, apicibus fuscis, subinteriores et interiores totae albae; exteriores late ovatae—rotundatae, obtusae; mediae ovatae vel ovato-oblongae—anguste ovatae, obtusae; subinteriores lanceolatae, subacutae, stipitatae; interiores breves, late ovatae, obtusae, longe stipitatae. Flores corolla c. 6 mm longa. Styli rami glabri, apice truncati, papillati. Setae pappi uniseriatae, breviter sed distincte plumosae, albae. Ovarium anguste oblongum, papillatum.

An undershrub, 1—3 dm high, branching from the base. Branches ascending, closely leafy to the top, or sometimes with a short pedunculoid apical portion below the flowerhead, densely grey-tomentose. Leaves close-set, erecto-patent—spreading, narrowly oblong—oblong-obovate, 1—2 cm long, 3—5 mm wide, flat, densely and adpressed grey-tomentose, obtuse—subacute, faintly midribbed on the lower side; uppermost leaves below the flowerhead sometimes brown scarious-tipped, forming transitions to the involucre scales. Capitula

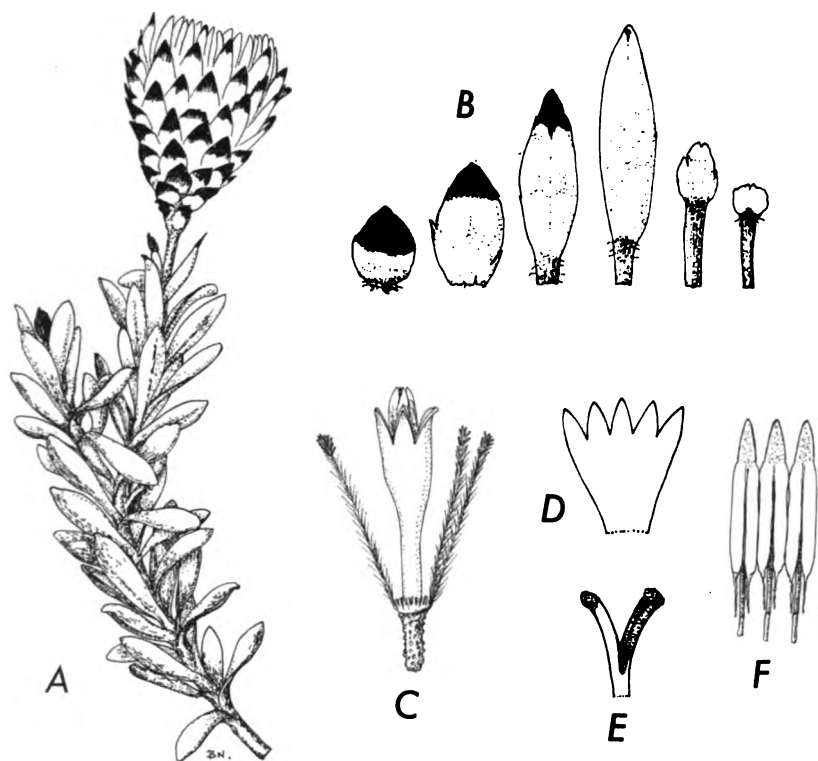


Fig. 3. *Helipterum montanum* B. Nord. — Drawing of an isotype, ESTERHUYSEN 26745 (LD). — A: Portion of plant,  $\times 1$ . — B: A series of involucral scales from the outer (left) to the innermost (right),  $\times 2$ . — C: Floret,  $\times 5$ . — D: Corolla, laid open,  $\times 5$ . — E: Style branches,  $\times 10$ . — F: Anthers,  $\times 10$ . — Del. auct.

solitary, terminal, often somewhat nodding, campanulate, 2—3 cm high and c. 2(—3) cm in diam. Involucral scales imbricate, glabrous, white (sometimes with a touch of pink) with light—dark brown tips, the inner and innermost wholly white; outer broadly ovate—rounded, obtuse; medial ovate or ovate-oblong—narrowly ovate, obtuse or subacute; inner lanceolate, subacute, stipitate; innermost short, broadly ovate, obtuse or rounded, long-stipitate. Disc 1—1.5 cm in diam., yellow. Florets numerous, all perfect. Corolla tubular and widening above or narrowly campanulate, 5.5—6.5 mm long; lobes 5, ovate—narrowly ovate, 0.9 mm long, minutely papillate on the outsides. Style branches 1—1.5 mm long, glabrous, shortly papillate on the outsides, with truncate papillate tips. Anthers 2.5—3 mm long incl. the narrowly

ovate acute appendage (0.6—0.8 mm long) and the fringed tails (0.6—1 mm long). Pappus bristles uniseriate, 15—25, 5—6.5 mm long, white, connate at the base for 0.5 mm or less, shortly plumose; lateral hairs 0.5—0.8 mm long, thin, the apical ones shorter, thicker, and with rounded tips. Achenes (immature) narrowly oblong, 1.5 mm long, papillate.

Flowering period: Mainly Oct.—Feb.

**South Africa.** Cape Province: Ladismith: Toverkop, 2200 m, IV. 1906, MARLOTH 4298 leg. G. J. JACKSON (PRE); Rock crevices on Toverkop, 7000 ft., 6.IX.1947, ESTERHUYSEN 14674 (BOL); Cliffs at foot of Toverkop, 6500 ft., 22.IV.1951, ESTERHUYSEN 18519 (BOL); Toverkop, S. and S.E. aspect, 6500—7000 ft., 17.XII.1956, ESTERHUYSEN 26745 (BOL, LD). — Laingsburg—Prince Albert: Seven Weeks Poort Mts., 2200 m, XII.1928, R. PRIMOS 50 (PRE); Seven Weeks Poort Berg, 5—7000 ft., XII.1928, K. H. BARNARD s.n. (SAM); Seven Weeks Poort, STOKOE 6594 (BOL). — Oudtshoorn—Prince Albert: Summit of Meirings Poort, II.1932, C. THORNE s.n. (SAM).

Among the about twenty South African representatives of *Helipterum*, there are three with quite a striking feature in common, viz. the 'chocolate and cream' coloured involucre. The three species are *H. variegatum* (Berg.) DC., *H. loganianum* Compt., and the new species, *H. montanum*. They all have more or less white involucre scales, tipped with various shades of brown.

*H. variegatum* is distinguished from our new species already by its size. It is a robust plant up to 6 dm tall with large rounded capitula up to 5 cm in diam. Other separating characters are the distinctly pedunculoid upper parts of the stems, the rounded to obtuse tips of the involucre scales, and the dark disc.

*H. loganianum* comes closest to *H. montanum* in habit and general appearance and no doubt also in affinity. It differs, inter alia, in having wider and less rounded capitula, more acute involucre scales, and bigger florets. Further, the pappus bristles are longer and more distinctly plumose, i.e. their lateral hairs are longer (up to 2 mm).

*H. montanum* is exclusively known from the Swartberg Range, where it is probably endemic. The species grows only at the highest altitudes (about 2000 m or more) and seems to prefer rock crevices on south facing cliff faces.

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## Smärre uppsatser och meddelanden

### Rubus Langei funnen i Sverige

*Rubus Langei* G. Jensen 1877, vilken är känd från England, norra Tyskland och sydöstra Jylland, har påträffats i sydligaste Skåne. Lokalen är belägen omkring 5 km öster om Ystad på en sandrygg  $\frac{1}{2}$  km från havet. Sedan 1961 har *R. Langei* observerats på en yta av ett 10-tal m<sup>2</sup>, i övrigt bevuxen med *Pinus sylvestris*, *Festuca rubra*, *Poa pratensis*, *Deschampsia flexuosa*, *Holcus lanatus*, *Fagus sylvatica*, *Quercus robur*, *Q. borealis*, *Rubus idaeus*, *Sorbus aucuparia*, *Chamaenerion angustifolium* och *Sambucus racemosa*. Bestämningen av denna för Sverige nya björnbärsart har bekräftats av M. P. CHRISTIANSEN, Köpenhamn, A. NEUMANN, Wien och TH. J. REICHGELT, Leiden. Beläggexemplar har överlämnats till Botaniska museet, Lund.

Beskrivning av *Rubus Langei*: Årstam omkring 2 m, bågböjd, kantig—fårad, brunlila, hårig; taggar ganska talrika, 7—10 mm, platta, med 3—6 mm bred bas och lång, sylformig spets, raka eller svagt böjda. Blad 5-taliga, något veckade, undertill mjukhåriga—gråfiltade; stipler lineära; småblad oregelbundet eller dubbelt sågade, de nedre med 2—3 mm långa skaft; uddblad vanligen bredast ovan mitten, 2—3 gånger skaftets längd, den drygt 1 cm långa spetsen oräknad. Klase ganska smal, med snett uppåtriktade grenar, högt upp bladig, tätt hårig, försedd med glandelbärande, fina taggar samt talrika platta taggar med lång, sylformig spets; foderblad ganska långt tillspetsade, utvändigt grå-ludna, ofta glandelbärande och med små taggar vid basen, bakåtböjda; kronblad skaftade, brett ovala, skära—vita, ståndarsträngar omkring 5 mm. Juli, augusti. —  $2n=28$ . Fig. 1.

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Fig. 1



Fig. 1. *Rubus Langei* G. Jensen. Teckning efter pressat material insamlat den 3 augusti 1963. — a. Avsnitt från mitten av årsskott; b. Topp av årsskott; c. Topp av blomskott.

***Erodium hirtum* (Forsk.) Willd. in Crete**

BOISSIER (*Flora orientalis* I 1867 s. 884) groups the "oriental" species of *Erodium* into two sections: *Barbata* and *Plumosa*. BRUMHARD (1905) and after him KNUTH (1912) apply the same division to the whole of the genus and divide the section *Barbata* into a number of subsections.

The species of *Erodium* hitherto recorded from Europe all belong to the *Barbata* section. It may therefore be of interest that a representative of the section *Plumosa* — *Erodium hirtum* (Forsk.) Willd. — was found in southern Crete in April 1961.

*E. hirtum* — like the other species of the section *Plumosa* — belongs to the desert regions of North Africa and East Asia. *E. hirtum* is probably the most widely spread of those species. Its area is extended from Morocco to Syria. In Morocco four localities are recorded from the south western coastal regions (JAHANDIEZ & MAIRE 1932; EMBERGER & MAIRE 1941). In Algeria the species is said to be rare and only found in three districts in the eastern parts of the country (QUÉZEL & SANTA 1963, II s. 576). KNUTH (1912) gives one locality from Tunisia, and MURBECK had as early as 1897 reported four Tunisian localities (MURBECK 1897 s. 54). KNUTH also mentions, without further specification, that the plant is found in Libya.

TÄCKHOLM (1956 s. 266) informs us that the species is very common in Egypt and found 1) in the mediterranean coastal strip from El-Sollum to Rafah, 2) in all the deserts of Egypt, 3) in the Sinai region. KNUTH (1912) lists a number of localities from Egypt.

There are also some records of the plant from "Palestine" and Syria (KNUTH 1912; EIG 1932; POST & DINSMORE 1932 s. 262).

Thus, available literature gives us the impression that *E. hirtum* has two centres of distribution: 1) The most important part of its area is Egypt, where it is very common. Outside Egypt it is less densely distributed to the west into Libya, Tunisia and eastern Algeria, and to the east into "Palestine" and Syria. 2) There is an apparently isolated group of localities in south western Morocco. It may be added that a certain var. *maroccanum* Maire (1923) has been described from this region; this fact suggests that the impression that the Morocco area of the species is isolated from the chief distribution of the species is not an illusion due to insufficient information.

The locality in Crete is a sandy hill c. 500 m from the sea, a few kilometres east of the town of Hierapetra on the south eastern coast of Crete. The hill is about 60 m high, and *E. hirtum* is found abundantly from the foot of the hill to its top.

*E. hirtum* is a perennial plant with a highly developed root system. Its root is branched, many decimetres long, up to 5 mm thick and furnished with ovoid tubers more than 1 centimetre large. A rich colony of such a plant must have considerable age, even if one takes into account that the vegetation of the locality is not very dense and thus the plant has not had to overcome very strong competition from other plants. On the other hand it seems reasonable that the plant has arrived in Crete during the last few centuries. In this connection the following points of view may be of value:

1. In *E. hirtum* the beak of the fruit is plumose (as in the other representa-

tives of the section *Plumosa*) and constitutes a good means of dispersal by the wind.

2. There seem to be many places in the vicinity of the hill suitable for the plant.

3. In spite of (1) and (2) the plant is evidently rare in Crete and in the neighbourhood of Hierapetra. Many botanical collectors have visited the island and this part of the island, but the plant has not been observed until now, though it is not difficult to recognise. The present writer has walked about a good deal in the vicinity of Hierapetra but has only seen the plant on the hill mentioned — not even between the hill and the sea.

4. Because of (1) and (2) there is no reason for believing that the Hierapetra colony of *E. hirtum* has relict character — that it should be a fragment of an earlier more extensive distribution in Crete. It must have arrived in Crete in historical time, probably from North Africa. It should be observed that the nearest point on the coast of Africa is within or at least near the region where the species has its densest occurrences.

5. When the plant arrived in Crete cannot be calculated, unless one makes experimental research on its ability and rapidity of spreading and growing in an environment similar to that of the surroundings of Hierapetra.

6. It can probably be excluded that the species has been deliberately introduced by man. It is not used as an ornamental plant, nor is it in any other way useful to man.

7. On the other hand it seems probable that the species has been brought unintentionally by human beings. One might guess that one or a few seeds have been brought by a ship to the port of Hierapetra and then transported in some way, for instance by the wind to the locality mentioned.

8. One possibility is that the plant has been introduced to Crete together with earth from North Africa. In that case one would expect to find other north African plants in the same locality. Personally I have only seen ordinary cretan plants on the hill, but I think it would be interesting to make a thorough inventory of the flora of the hill. When I found the *Erodium*, I did not realize that it was a find of special interest. So my notes of the flora are rather summary. I have intended to visit the place again but have hitherto only been able to return there at the end of December 1961, when the vegetation was not very well developed.

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UHERKOVICH, GÁBOR: Die *Scenedesmus*-Arten Ungarns. — Akadémiai Kiadó, Budapest 1966. 173 sid., 7+20 planscher. Pris kr 22:—.

I jämförelse med många andra växtgrupper hämmas den fykologiska forskningen i sötvatten av bristen på god bestämningslitteratur. Endast över ett fåtal alggrupper finns användbara handböcker varav de flesta är utsålda. Beträffande övriga grupper är man i regel hänvisad till hopplöst föråldrad litteratur, eller också saknas sådan. Naturligtvis finns det även en del orienterande översikter med ett begränsat antal representanter för olika grupper. Monografisk behandling av olika släkten är relativt sällsynt. I regel är man hänvisad till originalarbeten och beskrivningar. Då en stor del av sötvattensalgerna är kosmopoliter, det mest betydande undantaget är de rent tropiska, måste man följa med litteraturen från hela världen. Med hänsyn till artrikedomen, exempelvis *Navicula* över 1000 arter, *Chlamydomonas* över 500 arter, *Cosmarium* över 1000 arter och 1500 varieteter, etc. blir man givetvis tvungen till specialisering. Detta beror även på att bestämningsarbetet hos många sötvattensalger kräver ganska avancerade undersökningsmetoder och blir ytterst tidskrävande. Ofta är anläggandet av kulturer och elektronmikroskopiska undersökningar nödvändiga. Följaktligen gäller det att i varje fykologisk publikation komma underfund med hur bestämmningarna är utförda. Har man att göra med kritiskt gjorda undersökningar, eller är det ett summariskt arbete? Tyvärr är det senare ofta fallet och resultaten då oanvändbara i fytogeografiska och ekologiska sammanhang. En grupp av alger där det syndas mycket är grönalgsläktet *Scenedesmus*. Det är ett vittspritt och artrikt släkte, som finns rikligt i näringsrika vatten. *Scenedesmus*-arter används ofta i växtfysiologiska försök och i industriella masskulturer. Men trots att LAGERHEIM redan 1882 påvisade betydelsen av cellväggens struktur för taxonomin, så sker än i dag bestämmningar ofta enligt modellen: fyra spina — *quadricauda*, utan spina — *ecornis*, etc. Detta beror till stor del på svårigheten att hålla reda på speciallitteraturen och besväret att genom noggranna undersökningar få fram cellväggens struktur. För det sistnämnda är immersionsobjektiv och blekning av kloroplasten oftast nödvändigt. Vad bestämningslitteraturen beträffar så är BRUNNTHALER (1915) hopplöst föråldrad, de huvudsakligen på renkulturer grundade monografierna av SMITH (1916) och CHODAT (1926), som även tar en viss hänsyn till förhållandena i naturvatten, är användbara fastän ofullständiga. Sedan dessa arbeten utkommit har det beskrivits ett stort antal nya taxa från olika delar av världen, något som inte är lätt att hålla reda på. Därför är det med stor tillfredsställelse man tar del av den nyligen utkomna

*Scenedesmus*-monografin skriven av den kände ungerska fykologen GÁBOR UHERKOVICH. Denna bok behandlar visserligen endast de i Ungern förekommande arterna, 70 till antalet med en lång rad varieteter och former. Den är dock även i hög grad användbar för undersökningar utanför Ungerns gränser. Boken står trycktekniskt på en hög nivå. Beskrivningen av olika taxa är klar, och det finns en bestämningsnyckel. Författaren anför även många synonymer och ger hänvisningar till originalbeskrivningar. Naturligtvis kan man ibland anmäla avvikande värderingar beträffande några av de lägre taxonomiska enheterna. I sin helhet återspeglar boken den höga standarden hos den fykologiska forskningen i Ungern. Särskilt de rikt förekommande natronhaltiga småvattnen verkar vara ett eldorado för den mångfasetterade *Scenedesmus*-floran. Naturligtvis kan man vänta liknande rikhaltiga skörd från många håll, bara man får igång motsvarande intensiva undersökningar. Man hoppas verkligen att denna monografi kommer att ge många impulser! Och till sist, vad som gör att denna bok för lång tid framåt kommer att vara ett standardverk för alla sötvattensfykologer, är de synnerligen förnämliga illustrationerna. Boken avslutas med 20 planscher omfattande 824 (!) figurer, som alla är av mycket hög kvalitet. Figurerna är till betydande del ritade av UHERKOVICH och en hel del härstammar från HORTOBÁGYI. Man kan aldrig nog uppskatta värdet av illustrationer inom fykologin. En figur utan namn ger ofta mer än ett namn utan figur. Priset för denna bok är överraskande lågt, vilket ytterligare borde bidra till bokens spridning. Den är oundgänglig för alla som är intresserade av sötvattensalgernas ekologi och taxonomi.

KUNO THOMASSON

## Notiser

### Till medlemmarna i Nordisk Förening för Taxonomisk Botanik

1. Föreningen bildades vid ett möte i Lund den 8.6.1965. Förhandlingarna 8—12.6. 1965 har publicerats i Botaniska Notiser 118, fasc. 4 (1965) och tillsändes de medlemmar, som betalt sin årsavgift för 1966.

2. Till ordförande för tiden 1965—1967 utsågs i Lund professor HANS LUTHER, till sekreterare för samma period docent ARNE ROUSI. Föreningens adress är för denna verksamhetsperiod: Helsingfors Universitets Botaniska institution, Unionsgatan 44, Helsingfors 17.

3. Styrelsen har inom sig till vice ordförande utsett professor KAI LARSEN, Århus, som preliminärt inbjuder föreningen till möte i Århus och exkursioner på Jylland år 1969.

4. Styrelsen har beslutat att någon medlemsavgift för år 1965 icke uttages av medlemmarna. Årsavgiften för 1966 är fastslagen till 6 finska mark för enskild medlem och 60 finska mark för institutioner. Denna avgift torde snarast möjligt betalas till postgirokonto Finland 47—57225, Nordisk Förening för Taxonomisk Botanik, Botaniska Institutionen, Unionsgatan 44, Helsingfors 17.

5. Som nationsrepresentanter fungerar följande styrelseledamöter (deras suppleanter inom parentes)

Danmark: prof. KAI LARSEN, Århus (prof. ANDERS MUNK, København).

Norge: dr GUNVOR KNABEN, Oslo (mag. A. SKOGEN, Trondheim).

Sverige: prof. HENNING WEIMARCK, Lund (prof. J. A. NANNFELDT, Uppsala).

Finland: prof. ANTERO VAARAMA, Åbo (prof. JAAKKO JALAS, Helsingfors).

Nya medlemmar torde anmäla sig till någon av dessa personer.

6. Den norska nationsrepresentanten har meddelat, att Den botaniske afdeling av Det Kgl. Norske Videnskabers Selskabs Museum i Trondheim preliminärt inbjuder Föreningens medlemmar till en mellanårsexkursion (§ 3 i stadgarna) i Trondheimstrakten, ca 2 veckor av augusti 1966. Deltagarantalet är begränsat till ca 30. Hugade deltagare torde snarast möjligt insända preliminär anmälan till sin nationsrepresentant, som kan lämna närmare upplysningar om exkursionen. Denna är planerad att räkna 6 dagar, varvid såväl kustbygden som högfjällsnatur i Trollheimen skall besökas.

Helsingfors den 8 mars 1966.

HANS LUTHER  
ordf.

ARNE ROUSI  
sekr.

## On *Drepanocladus trichophyllus* in the Torneträsk Area

By MATS SONESSON

Department of Plant Ecology, Lund

(Received February 10th, 1966)

### Introduction

In 1961 the present author found *Drepanocladus trichophyllus* (Warnst.) Podp. with capsules in the Torneträsk area (N. Sweden). Cultivation experiments with spores from this material were performed in Lund (S. Sweden) 1962—1964. The results of this investigation as well as an ecologic survey of the species in the Torneträsk area are given here, while a more detailed description of the ecology of *D. trichophyllus* will appear in a future paper on mire vegetation in the Torneträsk area (SONESSON, in prep.).

The work has been carried out at the Department of Plant Ecology of Lund University (head of the department Laborator NILS MALMER). E. NYHOLM suggested the cultivation experiments. She has also confirmed and revised many determinations of *Drepanocladus*. N. MALMER, Å. PERSSON and H. RUNEMARK have offered valuable criticism concerning the manuscript, and O. MÄRTENSSON has provided much information on *Drepanocladus* in the Torneträsk area. M. VARGA has drawn the diagrams. Lund University and the foundation Seth M. Kempes Minne, Örnsköldsvik, have rendered financial assistance.

To all mentioned I wish to express my sincere gratitude.

The nomenclature of the vascular plants follows HYLANDER (1955). The bryophytes are according to NYHOLM (1954—1965) as to the groups until now treated by her. *Sphagnum* follows MÄRTENSSON (1956 a). The sampling and analysis of water were performed according to MALMER (1960, 1962 a). The terminology of mires and mire vegetation mainly follows SJÖRS (1950, 1952). For a map of the investigation area see MÄRTENSSON (1956 b) and the tourist map "Fjällen kring Abisko, Björkliden, Riksgränsen" (scale 1 : 100,000, the summer edition, Generalstabens litografiska anstalt, Stockholm 1948).



### Taxonomic Review

*Drepanocladus trichophyllus* (Warnst.) Podp. is one of the species in the taxonomically much discussed *Drepanocladus exannulatus* group. This complex is usually referred to the section *Warnstorfia* of the genus *Drepanocladus* together with *D. fluitans* s. lat. The vegetative morphological characters which in modern bryological literature are looked upon as the principal ones in distinguishing taxa in sect. *Warnstorfia* are the structure and arrangement of the angular cells, the length of the nerve and the denticulation of the leaves (as to North-European literature see e.g. H. PERSSON 1943, TUOMIKOSKI 1949, MÅRTENSSON 1956 a, H. PERSSON & SJÖRS 1960, NYHOLM 1965). NYHOLM (op. c.) also mentions anatomic differences of the nerve (cf. the characters of the nerve in *D. exannulatus* s. lat. according to TUOMIKOSKI op. c.). With regard to generative characters the main difference between *D. exannulatus* s. lat. and *D. fluitans* s. lat. is a dioicous gametophyte in the former and a monoicous gametophyte in the latter.

The *Drepanocladus exannulatus* group has been investigated by TUOMIKOSKI (op. c.) using primarily material from northern and north-eastern Europe. According to him *D. exannulatus* s. lat. consists of four species viz. *D. tundrae*, *D. procerus*, *D. trichophyllus* and *D. exannulatus* s. str. A fifth taxon in the same group, *D. purpurascens* (Schimp.) Loeske, recognized as a species by e.g. H. PERSSON (op. c.) and SJÖRS (1946, 1948, 1965, see also H. PERSSON & SJÖRS op. c.) is included by TUOMIKOSKI within the variation range of *D. exannulatus* s. str. MÅRTENSSON (1956 a, 1962) has followed TUOMIKOSKI, except in recognizing *D. purpurascens* as a variety of *D. exannulatus* s. str. NYHOLM (op. c.) has treated both *D. purpurascens* and *D. procerus* as varieties of *D. exannulatus* s. str.

All the authors mentioned regard *D. trichophyllus* as a good species. As to the experience of the present author it seems to be well circumscribed and relatively easily recognized in the investigation area.

On British material of *Drepanocladus exannulatus* s. lat. and *D. fluitans* s. lat. LODGE (1960 a) has quantitatively shown the very wide variation concerning e.g. the shape and proportions of the leaves, the length of the lamina cells etc. His experimental investigations (1959, 1960 b) have also shown that much of this variation is merely due to environmental influence and thus the characters concerned are of slight or no taxonomic value. The morphology and arrangement of the angular cells at the base of the leaf are however only slightly in-

fluenced by environment. In each of the collective species in question, LODGE thus distinguishes two different types of angular cells each with a narrow range of variation and without any continuous transitions (cf. also the above mentioned authors).

The relative length of the nerve of *D. exannulatus* s. lat. is to some extent correlated with the degree of submersion (LODGE 1959). The nerve however does not reach such a length that it extends to the end of the acumen of the leaf in the material investigated by LODGE.

When regarding also the boreal, subarctic-arctic material of *D. exannulatus* s. lat. it is evident that the variation of the relative length of the nerve is discontinuous too. WYNNE (1945) in her work with special reference to North-American material thus mentions the length of the nerve as a distinguishing character between *D. exannulatus* var. *typicus* (Dixon) Wynne and *D. exannulatus* var. *Rotae* (DeNot.) Grout. Similar results have been obtained on European material in the mentioned investigations by TUOMIKOSKI (1949). Within the *D. exannulatus* group *D. trichophyllus* is thus above all distinguished by the nerve which in typical cases, especially in the branch leaves, completely fills up the usually very long acumen of the leaf. In this character it differs from *D. exannulatus* var. *purpurascens* to which it has the closest resemblance in other respects (cf. H. PERSSON 1943, TUOMIKOSKI op. c., MÄRTENSSON 1956 a, NYHOLM 1965).

*Drepanocladus trichophyllus* seems to be a boreal circumpolar species (TUOMIKOSKI 1949, H. PERSSON & SCHACKLETTE 1960, NYHOLM op. c., see also WYNNE 1945, the description and figures on pp. 163, 165, 184 of *D. exannulatus* var. *Rotae*). It probably has its highest frequency in the continental areas.

### Cultivation Experiments

**The locality of the parent material.** Luovare in the low alpine belt (see DU RIETZ 1950, MÄRTENSSON 1956 b), c. 950 m above sea-level. — The locality is situated in an area at Mount Luopakte mainly occupied by poor dwarf-shrub heaths, small oligotrophic lakes and poor mires. In the eastern end of a small, shallow lake (c. 75 by 100 m and 50—100 cm in depth) poor mire vegetation occurs on the shore. The parent material was collected from a stand situated between a relatively broad zone of a *Drepanocladus trichophyllus* society close to the open surface of water on one side and a narrow zone of carpet vegetation dominated by *Carex rostrata*, *Eriophorum angustifolium*, *Sphag-*

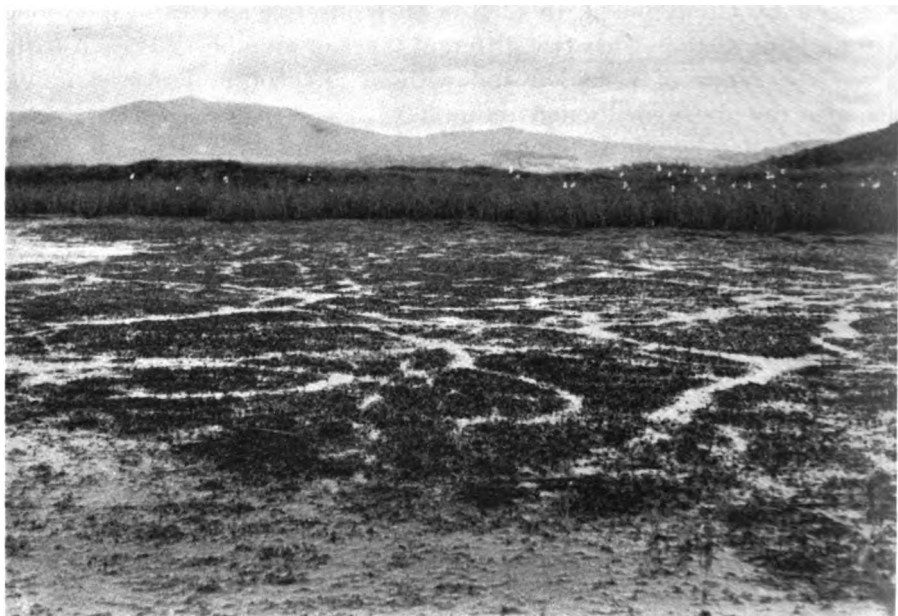


Fig. 1. Locality of parent material, Luovare, low alpine belt c. 950 m, 16.8.1961. In the foreground mats of primarily *Drepanocladus trichophyllus*. Sparse shoots of *Carex rostrata* and *Hippuris vulgaris* also occur. In the background a zone with *Carex rostrata*, *Eriophorum angustifolium*, *Sphagnum lindbergii* and *Drepanocladus schulzei*, bordering on an elevated part with hummock vegetation.

*num lindbergii*, *S. riparium* and *Drepanocladus schulzei* on the other side. The carpet borders on a rather large, somewhat elevated part with hummock vegetation. This vegetation is dominated by dwarf scrubs. *Sphagnum fuscum*, *Dicranum elongatum*, lichens etc. (Fig. 1). In the floating mats of *Drepanocladus trichophyllus* there are also other *Drepanocladus* types, mainly *D. exannulatus* var. *procerus* but also e.g. *D. exannulatus* var. *purpurascens* (falcate, weakly denticulate and in appearance much resembling var. *procerus*) and *D. schulzei*. Beneath the floating moss mats there are in some places on the bottom of the lake thick (c. 20—30 cm) layers of amongst others *Drepanocladus trichophyllus*. The bottom mainly consists of coarse mineral matter, probably stony till. Along the shores to the west and to the east the contribution of organic matter is rather large. Analysis of the water (19.8 1962) gave the following values: pH 5.8,  $\kappa_{\text{red}}$  23; dissolved constituents in  $\mu\text{mol}$  per litre: Na 60, K 12, Mg 27, Ca 35, S 137, P 0.6, Fe 25.

Four samples from two different years have been examined. Of in all 26 checked specimens, 7 appeared to be female and the rest sterile. Sporophytes were observed in 1961, 1962, 1963 and in a neighbouring (c. 800 m distant) locality in 1965. In 1964 no observations were made.

**The parent individual.** A typical specimen of *Drepanocladus trichophyllus* (see Fig. 3, cf. TUOMIKOSKI 1949, NYHOLM 1965). — On the occasion of sowing the percentage of morphologically well developed spores was approximately 50. However a greater share of the material germinated, but the percentage of viability was not calculated.

In 1965 a count of spores from the parent material of 1961 and from material in 1962 was made after staining with Cotton-blue. The diameter and degree of staining were determined. In each sample 400 spores were counted:

	Parent material	1962
Percentage of irregular spores .....	8 %	63 %
Percentage of unstained spores .....	11 „	} 37 „
Percentage of weakly stained spores .....	66 „	
Percentage of strongly stained spores .....	14 „	

**Distribution of diameter classes:**

	Parent material (stained, regular spores)	1962 (all spores)
10—< 13 $\mu$ .....	16 %	1 %
13—< 16 „ .....	54 „	27 „
16—< 19 „ .....	29 „	57 „
19—< 22 „ .....	1 „	14 „

**The cultivation.** In Februari 1962 spores were sown on a sterile agar medium (Beijerinck medium, see WHITEHOUSE 1961, p. 92) in sterilized Petri dishes. The dishes were placed before a window facing east at room temperature. After one week a great share of the spores had germinated and was homogeneously developed into a few mm long filamentous, somewhat branched protonemata. About 40 protonemata, randomly selected, were each placed on a small piece of agar in other Petri dishes. After some days more the first gametophore initials appeared on the vigorously branching protonemata. Morphological differences between these 40 protonemata were not observed. 19 pieces of agar with three week old individuals were placed on peat substrate in a sterilized pot each. The peat substrate was a dried, slightly humidified peat from a poor mire in the investigation area (main macrophytic constituents *Sphagnum fuscum* and *S. lindbergii*). The peat was soaked with distilled water and sterilized by boiling in water for at least one hour. Four to five pots were placed together in plastic dishes containing distilled boiled water up to or a little exceeding (c. 0—2 cm) the surface of the peat. The level of water was kept approximately constant during the whole time of

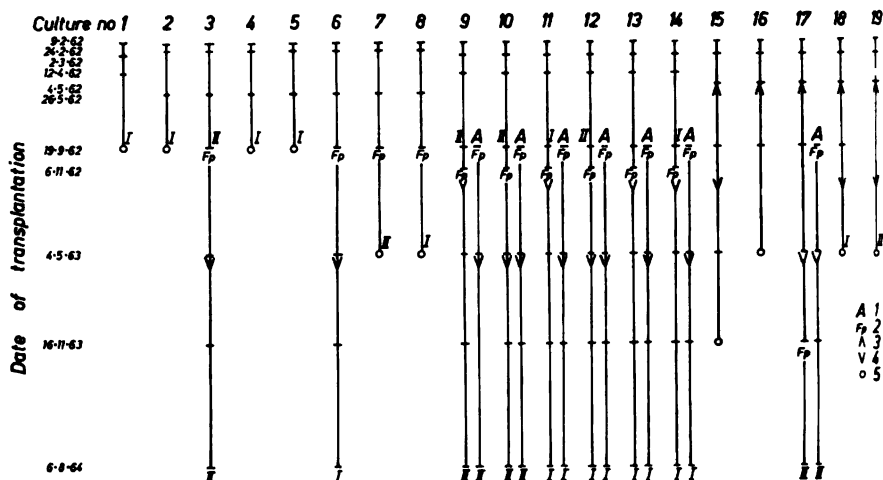


Fig. 2. Plan of cultures. 1 clone individual, 2 fresh peat, 3 tap water, 4 out of doors, 5 dead. The Roman numerals designate different nerve types, see the text.

cultivation. The dishes were kept in two plastic-clad wooden boxes covered with a plate of glass.

At the beginning the cultivation was carried out in a greenhouse with artificial illumination during the day and temperature normally between  $+10$  and  $+20^{\circ}\text{C}$ .

From the autumn of 1962 about a third of the moss material and from the summer of 1963 all the material was kept out of doors (see Fig. 2). During the whole time of cultivation the cultures were transplanted several times on new substrate and in new sterilized pots. In doing so all the material of each pot was transplanted except some shoots which were dried and preserved for later examination. To a large extent the condition of the material as to epiphytic growth of mainly blue-green algae decided the time of transplantation.

When transplanting in autumn of the first year seven of the more vigorously growing daughter individuals (strains) were each divided into two clone individuals parallelly cultivated (cf. the "A-individuals" of the strains indicated in Figs 2—4).

During a short period in May 1962 five individuals were irrigated with ordinary (boiled) tap water. In January 1963, on one occasion, the water in all pots was exchanged for water from a moderately rich mire near Lund. In that water were measured a pH of 6.5 and a  $\kappa_{\text{red}}$  of 210. On the same occasion pH and  $\kappa_{\text{red}}$  were determined in the water from the plastic dishes. pH was ranging from 7.1 to 7.3 and  $\kappa_{\text{red}}$  from 90 to 110. All these values much exceed those in water from the parent locality (cf. p. 382).

During the first months of 1962 the growth was very rapid. After about two months (in March—April) the shoots in most of the pots had reached c. 2—4 cm in length. They had also a few short branches irregularly distributed. The shoots in most of the pots were of about the same length. Later on, however, a variation in the growth, appearance and viability of the cultures became more prominent. Four of the individuals showed a slight growth and died (probably so) after about half a year in culture. In May the following year two others died. Also four other individuals apparently died in 1963. They might have been poisoned by tap water (see above). As to nos. 15 and 16 no material was found left in the pots in 1963. A few shoots of some individuals were prostrate but most of the shoots were erectly or suberectly growing at least as to the younger parts of the stems. Some shoots had imbricate leaves, others had spreading distant spaced leaves at a more or less right angle to the stems. The colour was pure green—yellowish green. Rather soon a reddish tinge appeared in many of the shoots especially on the stems.

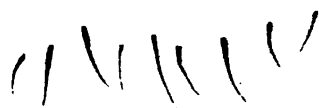
No generative organs were found in the material studied. In the material remaining in 1964 there were, however, in a few cases short branches with leaves much resembling those in fertile branches of spontaneously growing *Drepanocladus*.

During the summers and autumns the growth seemed to stagnate. It apparently depended on a more or less strong epiphytic growth of mainly *Cyanophyceae* (cf. ZASTROW 1934). Both in the spring of 1963 and of 1964 (in April—May) after thawing, however, a vigorous growth in the whole material was noticed. No algae were visible on those occasions. Also after the transplantations (algae mechanically removed) the growth much improved.

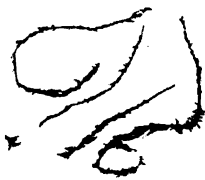
Exchange of dried substrate for fresh peat from the parent locality (cf. Fig. 2) seemed to have slight or no effect on the appearance and growth of the material. Nor had the supply of water rich in electrolytes, but boiled tap water apparently had a negative effect. The only obvious effect of keeping the cultures out of doors seemed to be a reduced growth of *Cyanophyceae*.

In the autumn of 1964 the cultivation was finished. At that time only nine of the primary nineteen daughter individuals remained. Seven of them had been cultivated as two different clone individuals each in separate pots since the autumn of 1962.

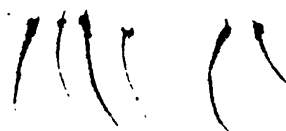
11A  
6-8 1964



11  
19-9 1962



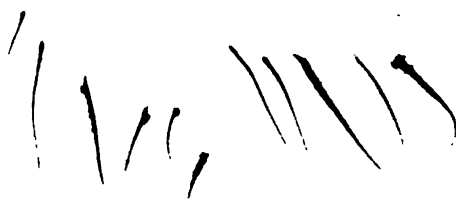
9A  
6-8 1964



9  
19-9 1962



5mm



5mm

Fig. 3. Parent individual (below) and two daughter individuals, the latter shown at two stages of development.

**Results.** All the remaining material in 1964 and the preserved material from the autumn of 1962 were examined as to the shape and proportions, the nerve, the denticulation and the angular cells of the leaves.

The dried material was soaked and boiled for a short time in 10 % KOH and then washed in tap water. In that way the leaves were cleaned of algal debris and the cell-walls of the nerve were also rendered a yellowish colour. From each individual the leaves were scraped off the stems and transferred into a Petri dish. The youngest (apical) leaves of the shoots were however disregarded. The leaves were then randomly selected from the dish and studied in the microscope at a magnification of  $\times 125$ . Fifty leaves proved to be a satisfactorily safe number as to the characters studied (cf. LODGE 1959). The same treatment was given to five different specimens of adult spontaneous *D. trichophyllus* from four localities, but in that case only the youngest parts were used. In the latter material branch leaves and stem leaves could also be distinguished and ten leaves of each kind from each specimen were studied.

The length and width of the leaf and the length of the nerve were measured with a calibrated micrometer eyepiece. Two separate measurements were made on the length of the nerve. The mean measuring error calculated on randomly selected values from the measurement records of the individuals (except herbarium material) amounted to 1.59 %, the standard deviation 1.217 ( $n=160$ ). The standard deviation ( $s$ ) was calculated according to the formula

$$s = \pm \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}.$$

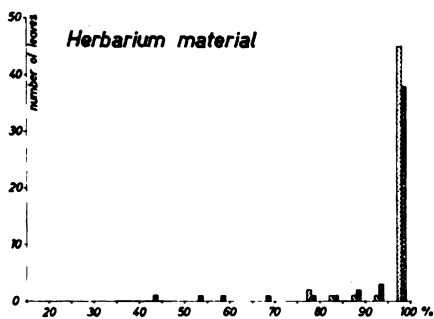
The relative values presented in the figures (in per cent) always refer to the length of the leaf.

The degree of denticulation was determined according to the following rough scale: 0 = not denticulated, 1 = weakly denticulated, 2 = normally denticulated, 3 = strongly denticulated.

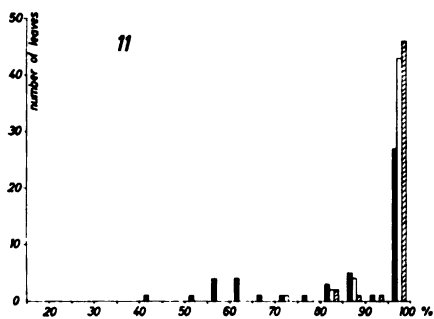
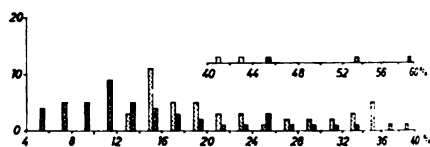
### The 1964 material

The shape and proportions of the leaves seemed to vary much. In the same clone individual, either on the same shoot or on different shoots, the leaves were long acuminate and more or less straight or slightly acuminate and falcate. Falcate, long acuminate and straight slightly acuminate leaves also occurred. In a few shoots a (basal) part of straight leaves and a (apical) part of almost circinate leaves were also seen. The first developed leaves at the base of the shoot were slightly acuminate and relatively broad. This type of leaves I call juvenile. The development towards a more adult stage appeared primarily in a relatively stronger growth of the acumen in relation to the basal parts of the leaf. The distance between the base of the leaf and the widest part varied slightly in comparison with the length of the leaf. In Fig. 5 the



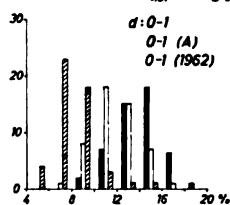


ml: 302 mm. s-1240 (branch leaves)  
 399 s-1207 (stem leaves)  
 d: 2 (branch leaves)  
 2-3 (stem leaves)



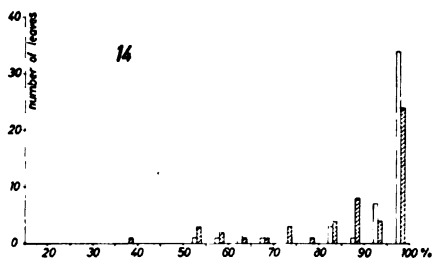
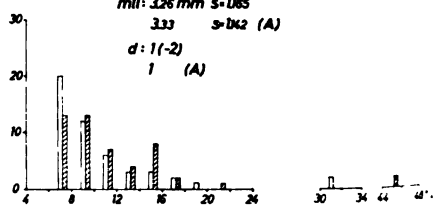
ml: 250 mm. s-0622  
 287 s-0685 (A)  
 187 s-0609 (1962)

d: 0-1  
 0-1 (A)  
 0-1 (1962)



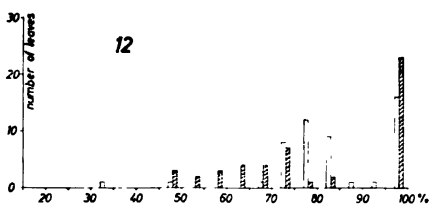
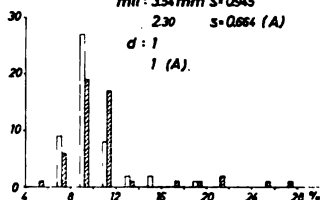
ml: 326 mm s-1085  
 333 s-1042 (A)

d: 1(-2)  
 1 (A)



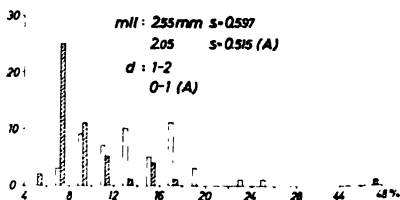
ml: 354 mm s-0945  
 230 s-0864 (A)

d: 1  
 1 (A)



ml: 255 mm s-0597  
 205 s-0515 (A)

d: 1-2  
 0-1 (A)



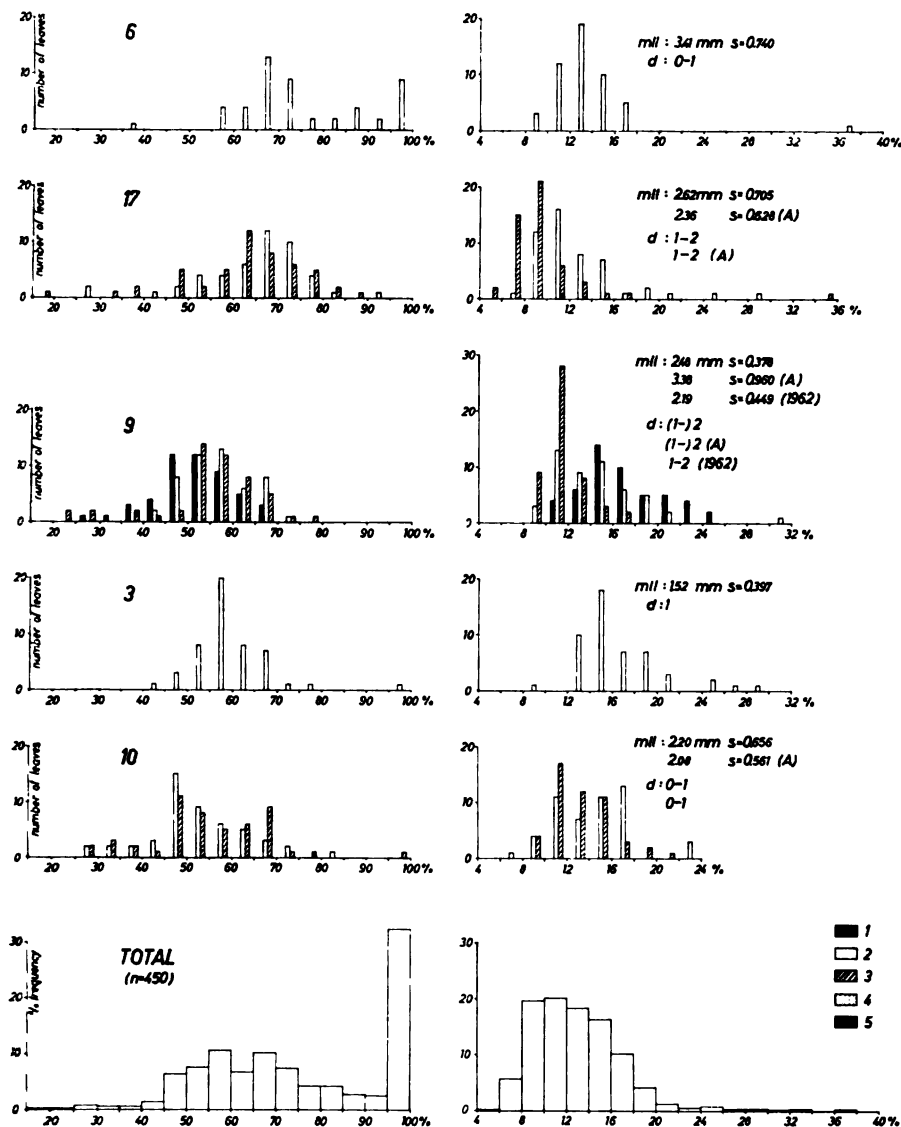


Fig. 4. Distribution of classes of relative nerve length (left column) and relative leaf width (right column). 1 material from 1962, 2 and 3 (=A) clone individuals of the same strain in material from 1964, 4 herbarium material, stem leaves, 5 ditto, branch leaves. mll=mean leaf length, d=degree of denticulation. The total histogram is composed of values from one individual of each daughter strain. All values refer to the length of leaf.

curves of the relative distance of leaf width and that of the relative leaf width accordingly have approximately the same courses. The relative leaf width seems to be a sufficiently good expression of the stage of development of the leaf with respect to the acumination.

In some cases there were rhizoid-initials or rhizoids growing from the lamina of the leaves.

The angular cells were very uniform in the whole material. They were of typical *D. trichophyllus*—*D. exannulatus* var. *purpurascens*-shape (see NYHOLM 1965 and LODGE 1960 a, p. 380, "type B").

The denticulation varied only slightly between the clone individuals except in no. 12 (Fig. 4). Between different strains however there was an obvious variation. In the separate shoots the juvenile leaves (cf. above) seemed to be somewhat less denticulated than the more developed ones. With regard to the whole material of progeny the denticulation was less than in the parent individual and in other material of spontaneous *D. trichophyllus*.

The nerve of the leaves (Fig. 4) completely (or nearly so) filled up the usually long narrow acumens of most of the leaves in three strains, nos. 11, 13 and 14, cultivated as three couples of (cf. Fig. 2) clone individuals (nerve type I).

In nos. 6 and 12, grown as 1+2 clone individuals, the nerve filled up the acumens in about half or less than half the number of leaves. The remainder however had a nerve extending for about 65—85 % of the length of the leaf. Some of these latter leaves were in appearance typical *D. trichophyllus* leaves with a long narrow acumen filled up by the nerve, but in the end the acumen broadened into a "spatula" composed of undifferentiated lamina-cells (included in nerve type I).

During the measurements there were sometimes occasions of uncertainty as to the real extension of the nerve. There were difficulties in delimiting the extension especially in those cases when the nerve seemed to be differentiating also from the end of the acumen. The highest classes of the relative nerve length in Fig. 4 may accordingly be somewhat underrepresented. As to no. 12 which caused the greatest trouble in this respect, reservations were made during measurements in four cases as to one clone individual (12 A) and in seven cases in the other. Even taking these reservations into consideration, however, the discontinuous distribution of frequency classes in no. 12 will still remain.

In the remaining strains, nos. 3, 9, 10 and 17, the length of the nerve was equivalent to about 50—75 % of the leaf length (nerve type II).

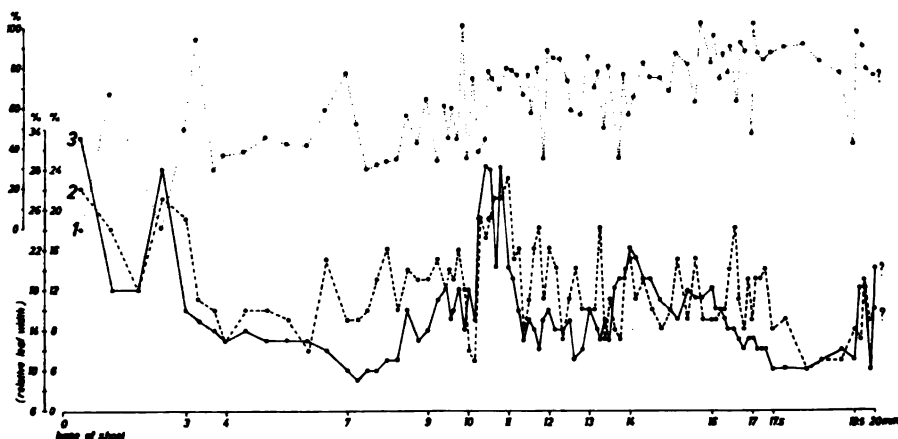


Fig. 5. Consecutive leaves of one unbranched shoot (no. 11, 4.5.1963). 1 relative nerve length, 2 relative leaf width, 3 relative distance to the widest part of the leaf from the base of the leaf. The values refer to the length of leaf.

With regard to all the material from 1964 it is possible to differentiate the strains into four different morphological categories concerning two of the characters studied, viz. the length of the nerve and the denticulation:

- I a. Nerve type I, weakly—normally denticulated
- I b. Nerve type I, not—weakly denticulated
- II a. Nerve type II, weakly—normally denticulated
- II b. Nerve type II, not—weakly denticulated

#### The 1962 material

The material from the autumn of 1962 was also studied in the microscope, though only in two cases, nos. 9 and 11, were measurements made. As to the nerve length and the denticulation the differences between the cultures from the two years in most cases were less than between different strains of each year. An exception, however, was no. 12 (cf. Fig. 2). As to nos. 6, 13 and 17 no material from the autumn of 1962 was preserved.

Nevertheless the material from 1962 was of course on the whole more juvenile as to the length of the nerve and the acumination of the leaves compared with the material from 1964.

**Discussion.** An apparent variation is shown in the progeny. Though

already seen during the cultivation in the general growth, appearance and viability, this variation appears most strikingly in the studied characters of the leaves.

The variation in shape and proportions of the leaves, angular cells, denticulation and nerve must mainly depend on environmental influence and/or the genetic background (as to the measuring errors, see p. 387).

The relative width of the leaves has quite a continuous variation. The difference between two clone individuals may be greater than between two different strains. The proportions of the leaf, mainly determined by the relative length of the acumen, is accordingly much influenced by environment. Principal environmental factors during the cultivation were no doubt the epiphytic algae and the varying treatments of the individuals. The frequencies of straight—falcate leaves, though not accurately measured, seem also to a great extent depend on environment. This is also in accordance with the results of the investigations on British material of *D. exannulatus* s. lat. performed by LODGE (1959, 1960 b).

A discontinuous variation is, however, apparent as to the relative length of the nerve. The difference between the clone individuals is also generally much less than between the different strains. The differences are too great to be explained merely by chance and measuring errors (non-binomially distributed). The total histogram (Fig. 4) indicates a 1 : 1 distribution of leaves with an “excurrent nerve” and those with a nerve extending for about 50—75 % of the length. This seems even more probable when considering a possible underrepresentation of the highest classes (cf. p. 390).

The histograms of two strains, nos. 6 and 12, are of approximately the same type as the total histogram. Also in nos. 3 and 10, otherwise typically belonging to nerve type category II there are a few leaves where the nerve completely fills up the acumen.

The two nerve types mentioned may however correspond to three different genotypes (or rather groups of genotypes):

- one which phenotypically very soon responds to environment in individuals where nearly all the leaves are long-nerved.
- one which phenotypically in a later stage responds to environment in individuals where the late parts of the shoots (or some late shoots) have almost exclusively long-nerved leaves.
- one which never or possibly very late responds to environment in long-nerved individuals.

As to the second genotype there is unfortunately not enough material left to check the separate shoots. There are, however, positive differences as to the relative nerve length of consecutive leaves in separate shoots indicating the possibility of different shoot generations in the material (see Fig. 5). With respect to the morphological differences seen between the shoots even in the same clone individual (cf. p. 387), it seems possible that the differences between the shoots in the same culture (i.e. the same clone individual) and also between various parts of one shoot may be great concerning the length of the nerve.

The different denticulation types presented seem also to be mainly genetically determined. However, this character is more difficult to determine and the accuracy is accordingly less than in the measurements of the nerve. Nevertheless the differences in this respect seen between different strains in the microscope were often striking.

Some of the categories of strains concerning the nerve and denticulation may also be recognized in nature:

As to nerve type I, the denticulate category (Ia) closely corresponds to the parent individual, *D. trichophyllus*. However, I have not observed a corresponding type of the non-denticulate—weakly denticulate category (Ib) in the field or on herbarium material, nor have I been able to find it being described in bryological literature. With respect to the nerve, strain nos. 6 and 12 may phenotypically come closest to a shore-type of *D. trichophyllus* (not seen by me) mentioned by TUOMIKOSKI (1949, p. 31). In this type the nerve does not fill up the extreme end of acumen.

As to nerve type II both the denticulate and the non-denticulate categories resemble *D. exannulatus* var. *purpurascens*. The distinctly denticulate type of the latter (corresponding to II a) is, however, uncommon in intermediate mire vegetation, but is common in richer and/or more dryly growing vegetation (cf. MÄRTENSSON 1956 a, pp. 256—259, 269, Å. PERSSON 1961, see also next section). It corresponds most closely to *D. exannulatus* s. str. according to TUOMIKOSKI (op. c., pp. 8, 37). He mentions the combination found in mixed moss samples between this species and *D. trichophyllus*, a rare combination. The non-denticulate—weakly denticulated category (II b) is closest to the falcate type of *D. exannulatus* var. *purpurascens* which is often found together with *D. trichophyllus* in intermediate waters and which also occurs in the parent locality (p. 382). It is in appearance very similar to *D. exannulatus* var. *procerus* and can safely be distinguished from the latter only in the microscope according to my experience. However,

with regard to vegetative characters, also concerning the angular cells, I am not in all cases convinced of the discontinuities between *D. exannulatus* var. *procerus* and *D. exannulatus* var. *purpurascens* in the Torneträsk area (cf. H. PERSSON 1943, p. 21).

It must be emphasized that the results of the cultivation are not directly applicable to the conditions in nature. The results obtained, however, indicate the possibility that some of the *Drepanocladus exannulatus* types met with in the field are results of occasional sexual processes between different genotypes, normally propagating vegetatively.

### Ecologic Conditions

*Drepanocladus trichophyllus* occurs in mire vegetation both above and beneath timberline. It is, however, most common beneath timberline. All the alpine localities hitherto found are situated in the low alpine belt (see DU RIETZ 1950, MÅRTENSSON 1956 a, p. 257).

I have found the species only in the poor western (westernmost locality at Vassijaure) and eastern parts of the investigation area. These parts are characterized mainly by a poor vegetation on soils derived from hard silicious rocks. In the central part of the area where a rich vegetation occurs and the rocks are generally softer and contain more calcium I have not found it. MÅRTENSSON (1956 a, p. 269), however, mentions it from Abiskojaure in the south-westernmost part of the Abisko valley which belongs to the rich central part in question. In this locality *Drepanocladus trichophyllus* grows together with *Scorpidium scorpioides*, *Drepanocladus exannulatus* var. *purpurascens* and *D. tundrae*. On the rich northern side of Lake Torneträsk *D. trichophyllus* seems to be very rare or missing (cf. Å. PERSSON 1961).

Plant communities with *Drepanocladus trichophyllus* are typical intermediate mire communities ". . . where some of the less exclusive species of rich fens mix with species of poor fens." (SJÖRS 1952, p. 248). Thus common followers of *Drepanocladus trichophyllus* are e.g. *Scorpidium scorpioides*, otherwise with the highest frequency in the rich mires, and some wetly growing *Sphagnum* species, especially *S. lindbergii*, *S. jensenii* and *S. riparium*, which are most common in the poor mires. Among the mosses *Drepanocladus exannulatus* var. *procerus* s. lat. (incl. *D. exannulatus* var. *purpurascens*, the type with none or weak denticulation, cf. p. 393) is most often found growing together with *D. trichophyllus*. These latter taxa seem to be good indicators of the

very wetly growing intermediate mire vegetation in the Torneträsk area. Especially in such communities that border on open surface water, *Drepanocladus trichophyllus* is found in the zone adjacent to the aquatic vegetation or to the surface of water devoid of macrophytic vegetation.

A common zonation (cf. Fig. 1) in the mires of the poor parts of the investigation area is:

- |  |   |
|--|---|
| 1. Zone of transition between terrestrial vegetation and mire vegetation | characterized by mire and terrestrial species, <i>Salix</i> spp. (esp. <i>S. lapponum</i> )   |
| 2. Hummock and lawn zone   | characterized by e.g. scrubs, lichens, <i>Sphagnum fuscum</i> , <i>S. robustum</i> , <i>S. balticum</i> , <i>Drepanocladus schulzei</i> <sup>1</sup>  |
| 3. Carpet zone (often quaking peat)                                      | characterized by e.g. <i>Carex</i> spp. ( <i>C. rostrata</i> , <i>C. rotundata</i> ), <i>Eriophorum angustifolium</i> , <i>Sphagnum lindbergii</i> , <i>Drepanocladus schulzei</i> <sup>1</sup>       |
| 4. Mud-bottom/magnocaricetum zone  | characterized by e.g. <i>Carex rostrata</i> , <i>Eriophorum angustifolium</i> , <i>Utricularia</i> spp., <i>Drep. exannulatus</i> var. <i>procerus</i> s. lat. <sup>2</sup> , <i>D. trichophyllus</i> |
| 5. Mud-bottom/aquatic zone   | characterized by e.g. <i>Drep. exannulatus</i> var. <i>procerus</i> s. lat. <sup>2</sup> , <i>D. trichophyllus</i> , <i>Utricularia</i> spp., <i>Sparganium</i> spp., <i>Potamogeton alpinus</i>      |
| 6. Open surface of water devoid of macrophytic vegetation                |   |

Some of the zones, especially nos. 2 and 3, may be missing or be poorly developed.

In the transition between zone no. 3 and 4 there are sometimes species otherwise most frequent in the plant communities of the mire margin, e.g. *Potentilla palustris*, *Carex canescens*, *C. magellanica*, *Sphagnum riparium*.

Though usually not growing in proper mud-bottoms the vegetation of zone no. 4 and 5 is phytosociologically often very similar to the vegetation on true mud-bottoms. The vascular plants accordingly grow scattered and the bottom layer is sparse. Often, however, the graminaceous plants are of a more luxuriant appearance than in mud-bottom communities. The transition is usually gradual between this type of

<sup>1</sup> High frequency, low cover.

<sup>2</sup> Incl. *D. exann. v. purpurascens* p.p. (see p. 394).



vegetation and that of typical magnocaricetum vegetation often occurring in the mentioned zones.

*Drepanocladus trichophyllus* occurs most frequently in the above mentioned types of very wetly growing vegetation, but it is also found in typical carpet vegetation though not frequently.

In the communities with *Drepanocladus trichophyllus* the water level is very constant during the vegetation period. It seldom varies more than  $\pm 5$  cm. During summer and early autumn the temperature of the surface water generally corresponds to the mean air temperature. In the shallow bodies of water (less than 1 m in depth) the temperatures at the bottom and the surface are approximately the same or differ by only a few degrees. Thus in July 1965 the measured water temperatures were usually between  $+8$  and  $+10^{\circ}\text{C}$  (cf. GRANMARK 1965).

*Drepanocladus trichophyllus* also grows submerged without any individuals on the surface (cf. TUOMIKOSKI 1949, MÄRTENSSON 1956 a, H. PERSSON & SHACKLETTE 1960). According to an investigation of the bottoms of some (c. 15) bodies of water along the shores down to about 3 metres at least some floating individuals of the species occurred in most cases at the places where it was found submerged. Stands with floating individuals and where no submerged ones were found also occurred. At least with regard to the populations in shallow water some of the individuals of the surface often seem to be attached to the bottom or to be connected with the submerged part of the population (or the submerged population).

The individuals of the populations are most often sterile, but sometimes also male or female gametophytes are found intermingled with the sterile ones.

*Drepanocladus trichophyllus* is found with sporophytes only in one locality in the investigation area (cf. p. 383).

When examining 15 collections from 13 different localities evenly distributed in the Torneträsk area I found besides sterile specimens only male individuals in 5 of the collections, only female ones in 6 and both male and female in one of the collections. The last collection originated from a "pals-mire" at the Torneträsk railway station (see MÄRTENSSON 1956 b, p. 27) in the eastern part of the investigation area. No sporophytes, however, were seen there. Since some of the collections were small and only derived from a small part of a stand the relative share of localities where both male and female gametophytes occur ought to be greater than appears from the examination.

The intermediate mire vegetation has a northern distribution in Sweden (cf. FRANSSON 1965, SJÖRS 1965). It is connected with a kind of

water also of an intermediate type. The water is thus characterized by a high pH in relation to the content of dissolved electrolytes (expressed as the specific electrical conductivity). This condition has several times been pointed out in the literature, first by SJÖRS (see SJÖRS 1946, 1948, 1950 and esp. 1952, see also Å. PERSSON 1961, 1962, 1965, MALMER 1962 a, 1963). As to the quantity of electrolytes it corresponds to the water occurring in poor mires (with bogs as the most extremely poor type) both in southern and northern Sweden, but pH is higher. Often the values of pH are about the same as what is measured in moderately rich mires in S. Sweden.

In water where *Drepanocladus trichophyllus* communities are recorded, the reduced specific conductivity<sup>1</sup> varies between c. 5 and 40. Generally the values in the different stands are very constant during the vegetation period. They correspond closest to those measured in poor mires in S. Sweden, even in the mud-bottoms of bogs (see WITTING 1948, MALMER 1962 b, 1965). Thus they are generally much lower than those of oligotrophic lakes in S. Sweden (MALMER 1961), but agree with values from this type of lakes in N. Sweden (LOHAMMAR 1938, 1965, SJÖRS 1946, GRANMARK 1965).

The content of  $\text{Ca}^{2+}$ , as one of the principal inorganic constituents of the water, is also closest corresponding to the values of poor mire waters. In three samples the quantity of  $\text{Ca}^{2+}$  has been measured to 41, 47 and 35  $\mu\text{mol}$  per litre respectively. These values are e.g. like those of poor mire waters in S. Sweden (MALMER 1962 a and b). They are lower than the mean values of oligotrophic lakes in S. Sweden and in the lowland of Norrland (MALMER 1960, 1961). GRANMARK (op. c.), however, mentions similar values from high-transparent lakes in Lule Lappmark (south of Torne Lappmark).

pH varies between c. 5.0 and 6.5 which broadly speaking corresponds to the values of oligotrophic lakes (see e.g. SJÖRS 1946, MALMER 1961 and literature quoted there) and of water in moderately rich or moderately poor mires (WITTING 1947, 1948, 1949, SJÖRS op. c., 1948, 1952, MALMER op. c., 1962 a and b, 1965). The range of variation in pH during summer and early autumn in the different stands seems seldom to exceed 0.5 units. In spring, however, the values of pH may be a little higher.

In waters of about the same specific conductivity mentioned but where pH is lower, it is primarily the *Sphagna* which become succes-

<sup>1</sup> See MALMER 1960.

sively more important and *Drepanocladus trichophyllus* and *D. exannulatus* var. *procerus* s. lat. less important. At pH less than c. 5.0, the latter mosses become rare or are completely missing, but e.g. *Sphagnum lindbergii* and *Drepanocladus schulzei* become frequent. In waters where the specific conductivity is higher, the opposite conditions prevail. *Sphagnum* species are accordingly missing, *Drepanocladus trichophyllus* and *D. exannulatus* var. *procerus* s. lat. are successively replaced by e.g. *Calliergon giganteum*, *C. trifarium*, *Drepanocladus revolvens* and *D. tundrae*. *Scorpidium scorpioides* is, however, the most prominent bryophyte of this richer, wetly growing vegetation, but it is also frequent in intermediate waters mentioned above. I have found neither *Drepanocladus trichophyllus* nor *D. exannulatus* var. *procerus* s. lat. in waters of a reduced conductivity exceeding c. 60.

### Summary

A cultivation of mosses from spores of one specimen of *Drepanocladus trichophyllus* (Warnst.) Podp. is described. A great variation in the progeny is demonstrated. The length of the nerve, the denticulation and the angular cells of the leaves appeared to be primarily genetically determined, while e.g. the shape and proportions of the leaf were to a great extent influenced by environment. As to the length of the nerve and the denticulation a discontinuous variation appeared. With regard to these characters four different morphological categories are possible to distinguish in the progeny. Two of them resemble *Drepanocladus trichophyllus* and two resemble *Drepanocladus exannulatus* var. *purpurascens* (Schimp.) Herz.

The ecologic conditions of spontaneously growing *Drepanocladus trichophyllus* is also described. It grows in water poor in dissolved electrolytes, but where pH is relatively high. These conditions, including the level of water, vary only slightly during the vegetation period.

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## **Vegetation and Microclimate along a Belt Transect from the Esker Knivsås**

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Knivsås, an esker with a very sharp profile, is situated on the slopes of Romeleåsen between Dalby and Hällestad, 15 km east of Lund (Fig. 1). The direction of the ridge is WSW to ENE, sloping mostly to the south and to the north. The esker and its vegetation has been popularly discussed in an earlier paper (PÅHLSSON 1964).

During the last glacial age the esker probably was formed in a tunnel or fissure in the ice-sheet which was moving from the northeast over the poor areas of Linderödsåsen. Moraines and glacifluvial deposits were left on a bedrock of gneiss, laid bare in a nearby stone-pit. In the end stage an ice-stream moved up from the southeast through the Vomb-depression with richer moraines. Perhaps such material also was deposited in the area. Finally the ice disappeared, the walls of the gravel bed collapsed and a sharp ridge was left (ÅBERG 1958).

Today most of the esker is covered with beech forest, but the central part is open pasture with scattered juniper shrubs. This vegetation has existed for a very long time. As a borderland between three villages, there have been common pastures or "fäladsmarker" for at least 200 years, perhaps longer (Maps, Hällestad). A marked feature of "fäladsmarker" on poor ground in southern Sweden is the scattered junipers with grass and heather (SELANDER 1957). On Knivsås, however, this vegetation varies in an interesting manner. The southern slope is covered with herbs, often richly flowering, but the northern slope has a grass vegetation rich in mosses. In the present paper this differentiation of the vegetation will be demonstrated by means of a belt transect across the esker. Further, some important microclimatic habitat conditions will be discussed based on a series of measurements on the two slopes in the middle of June 1964.



Fig. 1. Knivsås, the open part of the esker. — Photo L. PÅHLSSON, Sept. 17. 1963.

Similar investigations have been carried out earlier, e.g., by S. DZIUBALOWSKI (1923), W. L'UDI (1948), J. FABIJANOWSKI (1950), E. RAABE (1955), R. BORNKAMM (1958) and in Sweden by K. O. E. STENSTRÖM (HESSELMAN 1905) and E. STEEN (1957).

### Vegetation

The vegetation has been studied by a belt transect straight across the ridge in the eastern part of the open pasture land. There the slopes of the esker are exposed to the south and the north, respectively. In this part the vegetation also is rather free from the influence of the junipers which are common especially on the northern slope.

The belt transect was made up of squares  $\frac{1}{2} \times 1$  m with 1 m in the transect direction. The degree of cover was estimated according to the Hult-Sernander-Du Rietz scale with 5 degrees (DU RIETZ 1921). The nomenclature of the vascular plants follows WEIMARCK (1963), that of the bryophytes NYHOLM (1954–65) and as to the lichens MAGNUSSON (1929). There have been some difficulties in determining the species. The grazing of cattle often leaves only fragments of plants and the tramping damages mosses and lichens.

Perhaps these conditions also cause some typical features of this vegetation. Very few species have an unbroken occurrence along the transect. Further, most of the species have a low degree of cover.

The differences in the vegetation on the slopes appear from the belt transect (Fig. 2). In the field layer there are some species growing only on the southern slope: *Viscaria vulgaris*, *Rumex tenuifolius*, *Hypericum perforatum* and *Carex caryophylla*. During the springtime and the early summer, especially on spots between the grass tufts, short-living



plants are numerous, e.g., *Cerastium semidecandrum*, *Erophila verna* and *Myosotis hispida*. Other species are present only on the northern slope: *Anthoxanthum odoratum*, *Deschampsia flexuosa*, *Carex pilulifera*, *Rumex acetosa*, *Galium saxatile*, *Anemone nemorosa* and *Calluna vulgaris*. *Anemone nemorosa* is a spring flower with a somewhat decreased degree of cover at the time of the investigation.

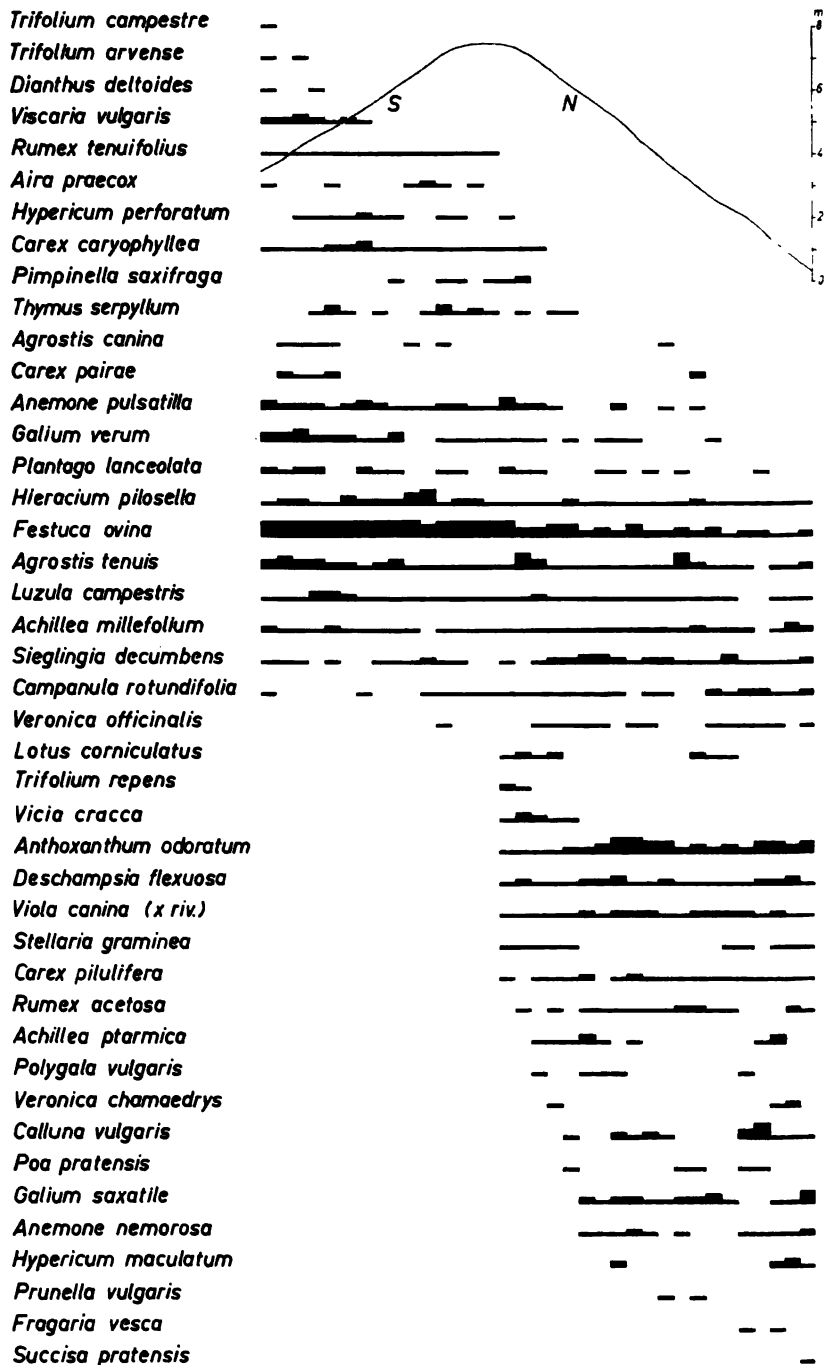
Some species are present on both slopes. Among these usually some prefer the southern, others the northern slope. Many dominating plants of the southern slope also can be found to a lesser extent on the opposite side of the esker. Such are *Festuca ovina*, *Anemone pulsatilla*, *Hieracium pilosella* and *Galium verum*. *Campanula rotundifolia* and *Sieglingia decumbens* seem to prefer the northern slope in the same manner.

Near the top *Trifolium repens* and *Vicia cracca* have special positions. In autumn *Gentianella baltica* also can be found in this part of the transect. *Pimpinella saxifraga* grows near the top with a tendency towards the south.

In the bottom layer the species are more specialized on one slope or the other. The mosses of the southern slope are low and scattered: *Brachythecium albicans*, *Rhodobryum roseum* and *Hypnum cupressiforme*. Lichens are common, e.g., *Cladonia rangiformis* and *Cladonia gracilis*. The latter is present also on the northern slope, but there the ground is covered by a thick carpet of mosses. Dominating are *Hylocomium splendens* and *Pleurozium schreberi* with an intermixture of *Polytrichum formosum* and *Rhytidiadelphus triquetrus*. *Dicranum scoparium* is as common on the southern as on the northern slope.

The presence and the degree of cover of some mosses vary on the





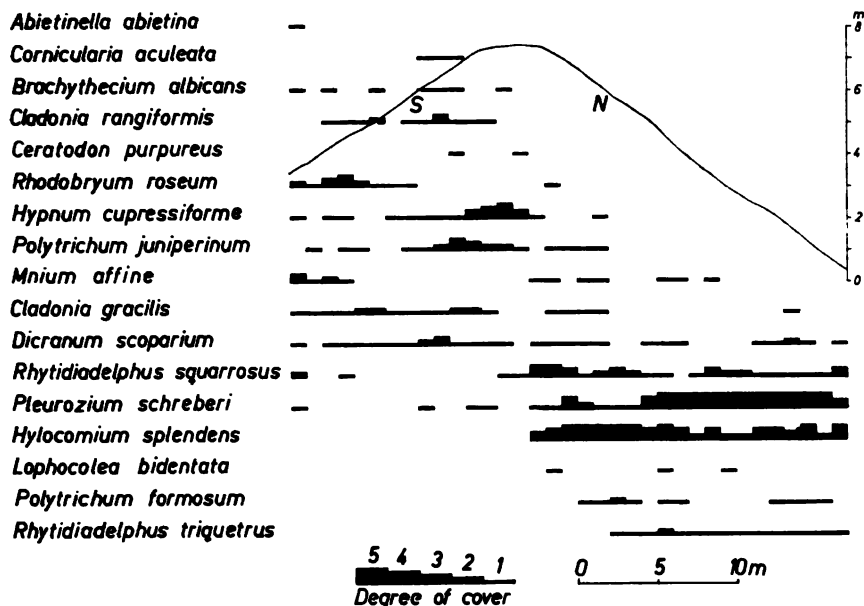


Fig. 2. Belt transect across the eastern part of Knivsås, July 30, 1964. Additional species present only in one or two squares with low degree of cover: The southern slope: *Arenaria serpyllifolia* (1), *Cerastium holosteoides* (2), *Cerastium semidecandrum* (6), *Prunus spinosa* (3), *Cetraria islandica* (11, 12), *Cladonia rangiferina* (12) and *Peltigera canina* (5). Near the top: *Antennaria dioica* (17, 18), *Cirsium acaule* (16) and *Platanthera bifolia* (18). The northern slope: *Chrysanthemum leucanthemum* (31), *Cerastium holosteoides* (34), *Festuca rubra* (25, 28), *Gnaphalium sylvaticum* (26), *Juniperus communis* (25, 26), *Leontodon hispidus* (34), *Potentilla erecta* (25), *Quercus robur* (32), *Vaccinium myrtillus* (18) and *Atrichum undulatum* (22). (Numbers=squares from S to N.)

slopes. *Rhodobryum roseum* disappears at a high level, where *Hypnum cupressiforme* and *Polytrichum juniperinum* are frequent. On the northern slope *Hylocomium* and *Pleurozium* have a slightly different distribution. These differences are difficult to find in the field layer except for *Pimpinella saxifraga* which grows in the same areas as *Hypnum* and *Polytrichum*. The possible ecological background of these conditions will not be discussed here.

### Microclimate

The microclimatic conditions of the slopes were investigated with two sets of instruments, one on each side of the esker. On the southern

slope, site K 11, the instruments were mounted about 8 m from the top. and on the northern slope, site K 4, about 14 m, this difference depending on the shape of the esker and the vegetation conditions. The natural horizon of the two sites was as follows. (Numbers of degrees=approximate height of obstacles over the theoretical horizon at one meter above the ground.)

K 11: Direction SSE. Slope angle  $23^{\circ}$  (appr.).

N→E The esker and bushes of *Prunus* and *Fagus* ( $15^{\circ}$ ). (NNE small juniper 2 m from instruments.) E→S→SW Free horizon. SW→W Distant forest ( $2^{\circ}$ ). W Small beech ( $25^{\circ}$ ). W→N Scattered junipers and the esker ( $15^{\circ}$ ).

K 4: Direction NNW—N. Slope angle  $29^{\circ}$  (appr.).

N→NNE Free horizon. NNE→E Beech forest ( $8^{\circ}$ ). E Beech ( $20^{\circ}$ ). E→S The esker with junipers ( $15$ — $20^{\circ}$ ). SE Higher bushes of beech and juniper ( $30^{\circ}$ ). S→W The esker and from SW also junipers ( $20^{\circ}$ ). W→N Free horizon.

The investigation was carried out from June 17, 9<sup>00</sup> a.m. until June 18, 21<sup>00</sup> p.m. 1964. Records were made every hour at the same time on the two slopes.

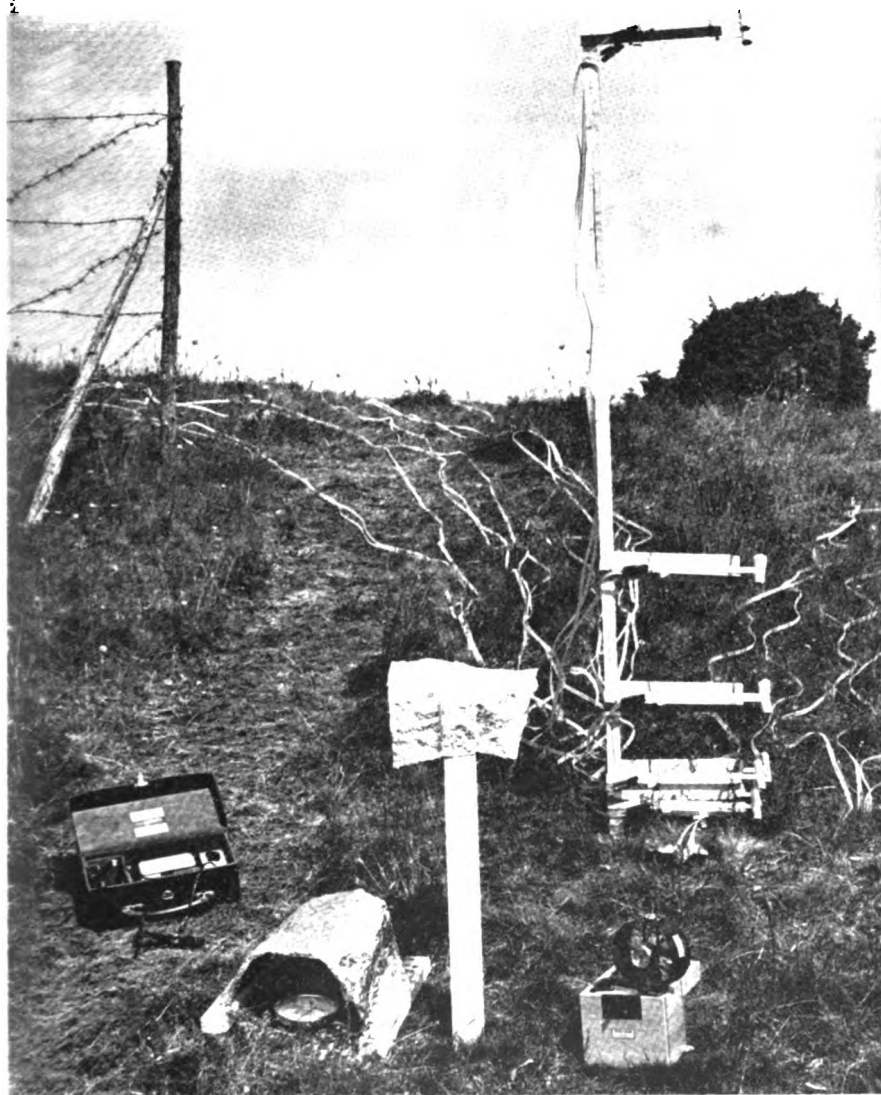
### Instruments and Methods

Each measuring station (Fig. 3) was equipped with instruments furnishing different microclimatic data.

**Light** was measured with an "EEL Lightmaster Photometer" luxmeter. The sensitive part of selenium was formed as a plate with a handle connected by a wire to the indicating instrument. This had three measuring ranges 0—10/100/1000×100 lux. Further a neutral filter (about 10×) could be fitted to the selenium plate to extend the sensibility over 100 thousand lux. During the measuring this plate was held parallel to the ground surface. Both incoming and reflected light were recorded. The incoming light was measured just over the grazed vegetation and the reflected light at about 40 cm above the ground.

**Wind.** The Lambrecht propeller-anemometer no. 1400 was used to measure wind velocity. It gives accurate records between 0.3—20 m/sec and is calibrated by the manufacturer. The wind was measured at 50 cm over the ground for two minutes and then the average velocity has been calculated. However, the anemometer is constructed for measuring only straight against the wind direction. Especially when the wind direction was changing and had a low velocity, there was some difficulty in handling the instrument properly.

**Temperatures** at different levels over the ground were recorded with the aid of small resistance thermometers. They were manufactured by HAFO. Stockholm with the designation Pearl-thermistors, type N. Their resistance at



**Fig. 3. Instruments at K 11 June 18, 1964. From left: EEL luxmeter, Lambrecht hygrometer, Lambrecht propeller-anemometer and thermistors mounted on a wooden stand. — Photo L. PÄHLSSON.**

25°C was about 4000  $\Omega$  and their diameter about 1 mm. The thermistors were soldered to double wires (TV aerial wire) with small contacts in the opposite ends. These were fitted into the indicating instrument, Normameter model 185 R 1, a Wheatstone bridge with six measuring ranges from 0.08 to 60 thousand  $\Omega$ .

The thermistors were calibrated in air of different temperature. Stable conditions were attained in modern constant rooms. Calibration diagrams were constructed and the thermistors were checked according to an accurate mercury thermometer before use.

Temperature measurements are often attended with radiation errors. To eliminate these as much as possible the thermistors were protected with radiation shields, which on the outside were highly reflecting and on the inside black, the shape and size according to MATTSSON 1961, but modified. The small size of the thermistors also diminish radiation errors.

The thermistors with their radiation shields were mounted on a wooden stand at 5, 10, 25, 50 and 150 cm above the ground, two thermistors at each level. On the ground two thermistors were fixed and they were sheltered from direct sun radiation with reflecting aluminium sheets.

Soil temperatures were measured with some larger thermistors (HAFO. Type B 5). Their diameter was about 5 mm and they were protected against moisture with a thin layer of transparent cement ("RX-lim"). A small pit was dug and the thermistors, two at each level were fixed in the walls 3 and 25 cm below the surface. The pit was closed again and the vegetation on the surface was restored.

In testing both types of thermistors in constant temperatures before use errors depending on calibration and readings on the normameter were estimated to some tenths of a degree. Thermocouples with radiation shields of the same type as that of the N-thermistors have been tested (MATTSSON 1961). With intense radiation and some air movement the errors was about 1°C. The difference between two thermistors (both types) at the same level mostly was < 0.5°C and rarely > 1°C. Temperatures are given as the mean of the two thermistors.

Relative humidity was measured with a Lambrecht hair hygrometer no. 194. The Pernix-type was used giving better values at low humidity and at different temperatures, also low. One hygrometer was laid directly on the ground with the vegetation undisturbed around it. Another was mounted on a wooden pole at 50 cm above the ground. Before measuring they were wrapped in wet towels for about half an hour to be regenerated. Both were shielded with aluminium sheets from radiation.

### Weather Conditions

Observations of the weather were made at every recording during the period. In the morning of June 17 the sun was shining, but before the investigation began it became cloudy and very soon it was raining. This rain continued until 15<sup>00</sup> p.m. with a short cessation about noon. After 15<sup>00</sup> p.m. the clouds broke up and at 18<sup>00</sup> p.m. the weather was

clear with sun. Then the whole night was clear, but before 3 o'clock in the morning of June 18, mist was formed near the ground and soon enveloped the esker. Three hours later the mist, which sometimes had been rather light, lifted and clouds at a higher level were formed. At 9<sup>00</sup> o'clock the sky was nearly clear and then followed a clear warm summer day with small scattered clouds in a blue sky until the end of the investigation period at 21<sup>00</sup> o'clock. However, a slight haze at a high level was observed from 17<sup>00</sup> p.m. until 19<sup>00</sup> p.m. Both days the sun rose at 03<sup>25</sup> a.m. and set at 20<sup>52</sup> p.m. (K. Vetenskapsakad. 1963).

A more complete picture of the weather can be obtained from the meteorological station at Bulltofta airport, Malmö, about 25 km from Knivsås. In some points there are small differences, but it is of interest to compare the observations from the esker with these from the airport:

#### Approximate values

Time	Wind direction	Wind velocity m/sec	Cloud covered part of the sky/8	Cloud types	Cloud height 100 m	Weather
17/6						
8—9	WSW	8—5.5	4—7	cumulus	5—9	clouds form
10—15	WSW	6—5.5 (11—12: 3.3)	8	strato- cumulus	9 and 14	rain
16—17	NNW	4	7—5	strato- cumulus	12	clouds dissipate
18—19	NNW	1.5	2	cumulus	9	± clear
20—22	—	0	6—3	cirrus	60	„
18/6						
23—3	—	0	4—1	strato- cumulus	20	± clear
4—5	—	0	1	cirrus	60	± clear, mist is forming
6—8	—	0	7—4	strato- cumulus	12	(± clear), mist
2—16	mostly W (11: NNW)	3.5—1.5	3—1	cumulus	9—16	± clear
17—18	SW—S	3—2	3—2	cirrus	60	„
19—22	SE	2	3	alto- cumulus	50	„

#### Light Conditions

During the cloudy and rainy weather of June 17, no differences were observed in incoming light intensity between the slopes (Fig. 4). Quite different conditions set in during the clear weather of June 18. In the morning until 8<sup>00</sup> a.m. light intensities were the same on the two slopes

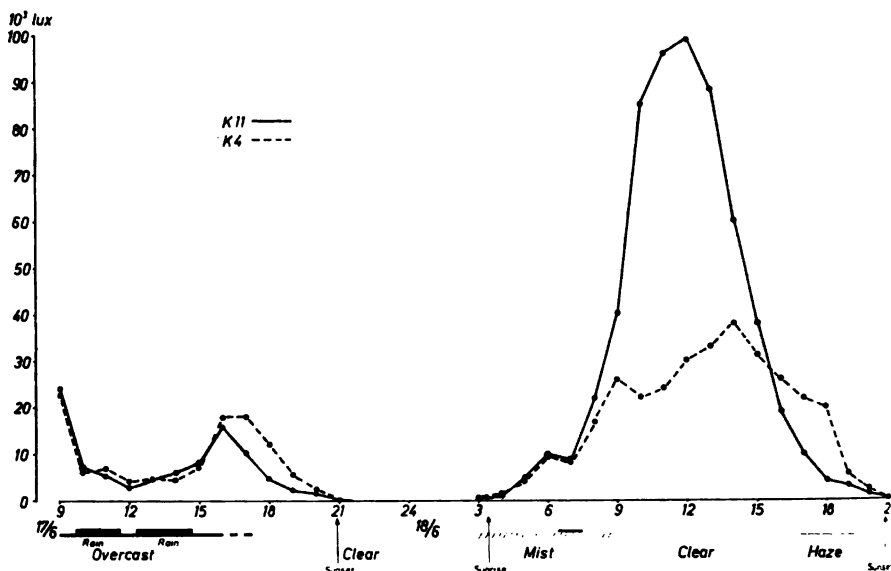


Fig. 4. The course of light intensities.

depending on the mist and the clouds. But then in few hours the light values of the southern slope, K 11, rose to more than 90 thousand lux. During the same period the northern slope, K 4, only showed about 30 thousand lux.

The sun rays strike the ground surface of the two slopes at different angles. On the southern slope they form a more of a right angle with the surface than on the northern where the rays almost sweep along the slope.

After 13<sup>00</sup> p.m. the values of K 11 dropped rather quickly again and somewhere between 15<sup>00</sup> and 16<sup>00</sup> p.m. K 4 attained higher light values than K 11 and this lasted until sunset. The same relations were observed in the evening of the preceding day, when the clouds had disappeared. In the evening the sun rays got to the northern slope and left the southern. However, the light intensity of the evening sun was far below that of the noon and the values were rather small. Certainly the northern slope receives more light than the southern also in the morning. That time was disturbed by mist during the investigation period.

The reflected light gave rather low values compared with the incoming light. Highest value of K 11 was 4600 lux and of K 4 3000 lux.

If the incoming light intensities are interpreted as values of energy, the southern slope receives an excess of energy during clear days

(STRAHLER 1960). On this distribution of energy depend most of the ecological factors of importance for the differentiation of the vegetation on the esker. Most of the energy will be transformed into heat.

### Temperature Conditions

Characteristic of the temperature distribution in the layers of air near the ground during a clear summer day are very high temperatures in the lowest layers which decrease with increasing height, the 'incoming radiation type' (GEIGER 1961). This type was most extremely developed during the investigation period at noon on June 18 (Fig. 5 C). When the temperature on the southern slope at 150 cm was 23.6°C, the temperature in low vegetation on the ground was 37.6°C. On the northern slope the air temperatures were some degrees lower. There the maximum occurred 5 cm above the ground depending on the thick moss carpet. The temperature at 0 cm was only 20.5°C. The soil temperatures at 3 cm showed the greatest difference, K 11 31.5°C and K 4 14.9°C. Lower, at 25 cm, the two slopes only differed some degrees.

With regard to the light measuring a temperature difference between the slopes could be expected. However, the temperatures of the air often are about the same at the two sites. The important feature of the temperature distribution is the great differences just at the ground surface and adjacent layers. These differences are enhanced by the vegetation of the northern slope, especially the moss carpet, which impedes the supply of energy to the ground surface.

June 17 the weather was mostly overcast. In rain the incoming radiation type was highly modified (Fig. 5 A). Almost the same temperature prevailed on the two slopes at all levels in the air. But in the soil K 11 had a heat reservoir from clear days (GEIGER 1961) about three degrees higher than K 4. After only a short interruption in the rain also the air temperatures were higher at K 11. The 'incoming radiation type' can be recognized too (Fig. 5 B). In the evening light intensities were higher on the northern slope. Also the air temperatures were more favourable for a short time (Fig. 5 D).

In the clear night only long-wave radiation occurs from the ground which together with the adjacent layers of air loses heat. The resulting temperature distribution is called 'outgoing radiation type'. At 2<sup>00</sup> a.m. of June 18 this type occurred (Fig. 5 E). It is remarkable that K 11 had lower soil temperatures near the surface than K 4. Again the moss carpet impedes radiation, now with the reverse effect.



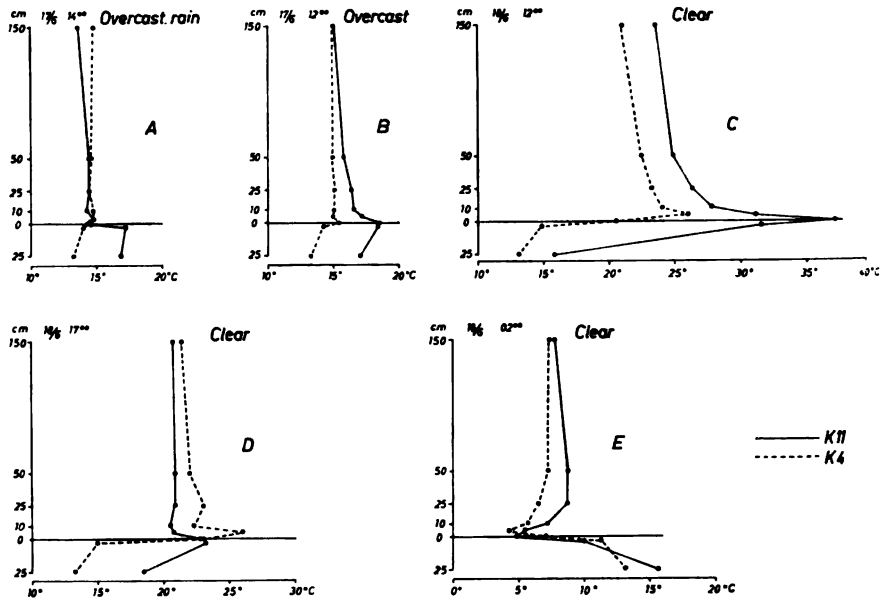
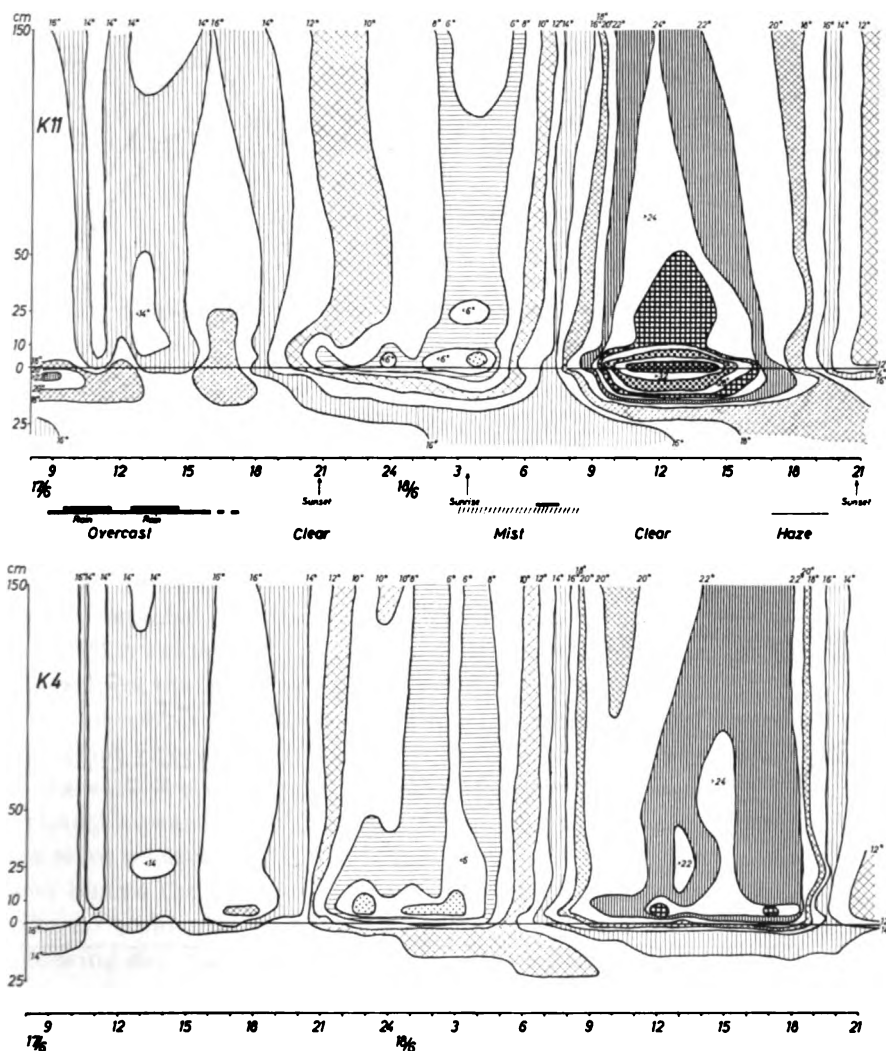


Fig. 5. Temperature distribution of the air and the soil at certain times during the investigation period.

To show the complete picture of the temperatures isopleth diagrams have been constructed with isotherms for every second degree (Fig. 6). During June 17 and the following night air temperatures were almost equal at K 11 and K 4. Yet the cool period in the night was longer at K 4. However, very near the ground and in the soil temperature differences were greater. When the rain stopped at 15<sup>00</sup> the soil of K 11 rapidly increased its temperature, while almost nothing occurred at K 4. In the night the soil of K 4 was better isolated by the moss carpet than the rather naked soil surface of K 11. Isothermy prevailed in the morning of June 18 and then a clear day with hot temperatures at K 11 and cooler at K 4 followed. The soil temperature near the surface rose very quickly at K 11 to a high level, but it increased very slowly at K 4 to only a few degrees more than during the night. At K 4 at the 5 cm level above the ground two maxima occurred, one at noon and one in the late afternoon depending on the position of the sun mentioned above.

In the soil heat is transported almost entirely through molecular conductivity (GEIGER 1961). A certain amount of heat at the ground



surface is slowly transmitted to deeper levels. The isopleth diagram shows this delay, but it is more marked in the temperature course of the soil temperatures (Fig. 7). At the 3 cm level the maximum, obtained at noon of June 18 on the surface, occurred with a delay of one hour on the southern slope and of two hours on the northern. (The absolute maximum at K 4 was later in the evening at 18<sup>00</sup> p.m.) The same figures

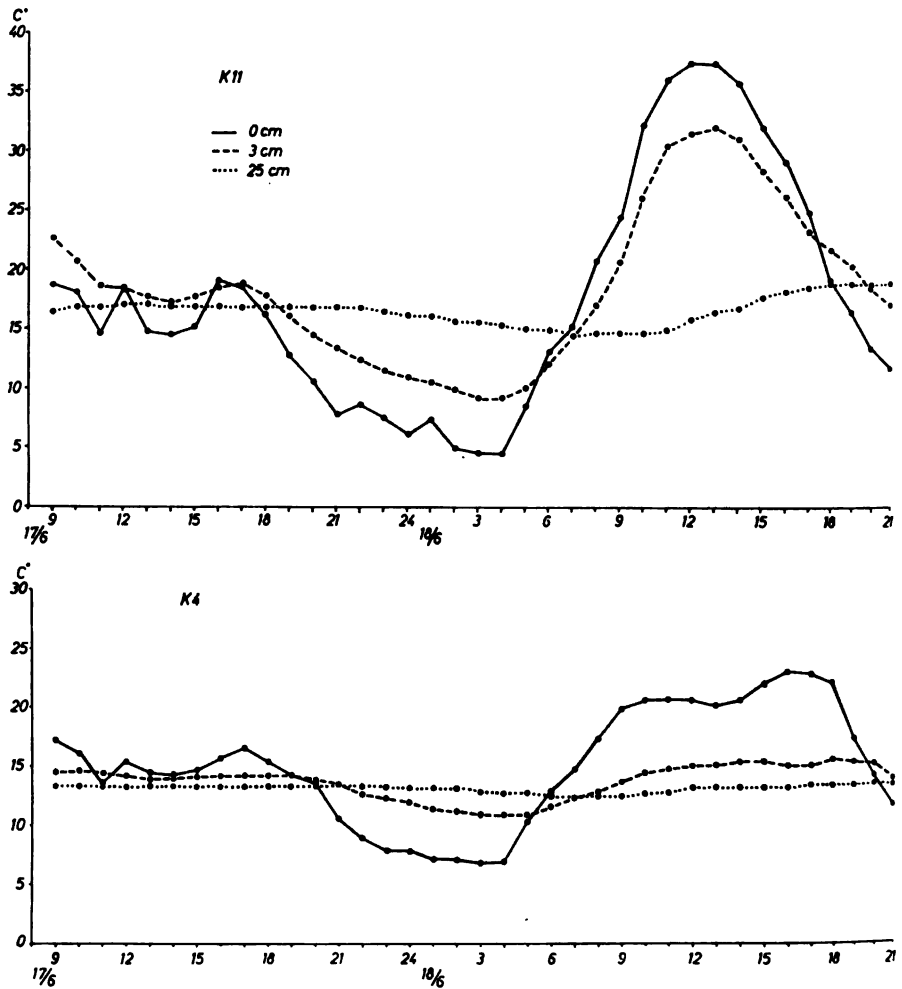


Fig. 7. The course of the temperature at the ground surface and in the soil.

at the 25 cm level were 6 and 8 hours respectively. Thus K 4 reaches its maxima later than K 11.

The temperature amplitude also decreases with the depth. But more important in this comparison of K 11 and K 4 is that the temperature amplitude at K 11 was much greater than that of K 4, especially near the surface. At K 11 the minimum temperature at 3 cm was  $9.2^{\circ}\text{C}$  and the maximum temperature  $32.0^{\circ}\text{C}$ . The corresponding figures of K 4 were  $10.9^{\circ}\text{C}$  and  $15.2^{\circ}\text{C}$ . With regard to this the soil climate of the

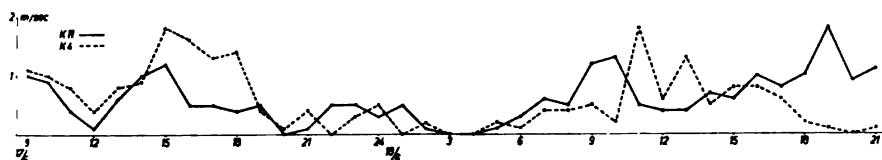


Fig. 8. The course of wind velocities.

southern slope can be characterized as microclimatically continental and that of the northern slope as maritime (STEEN 1957).

### Wind Conditions

During the investigation period wind velocities were low, less than 2 m/sec. at 50 cm above the ground. This is of importance because windy weather greatly affects the temperature distribution near the ground. The characteristic features of incoming and outgoing radiation types disappear. Especially the night temperatures are sensible to the wind (MATTSSON 1961). It seems as if the wind had no or very little effect upon the temperatures during the period.

The observations at Bulltofta airport concerning wind directions and also wind velocities are well reproduced at Knivsås (Fig. 8). At noon, on June 17 there was a calm period followed by increasing wind and a change towards NW. Between 15<sup>00</sup> p.m. and 18<sup>00</sup> p.m. higher velocities were measured at K 4, while earlier in the day wind velocities had been almost the same on the two slopes with a westerly wind. At Bulltofta no wind was measured from 20<sup>00</sup> p.m. until the morning of the following day. Yet light winds were measured over the slopes of Knivsås during the first part of the night. The wind direction at this time was from the top of the esker down along the slopes. Probably these winds were a flow of descending cold air (GEIGER 1961).

June 18 the wind was westerly and rather light. A sudden change towards NW at 11<sup>00</sup> a.m. brought about increased velocity at K 4 and a more southerly wind in the evening gave higher values at K 11.

### Humidity Conditions

The humidity conditions near the ground depend on the evaporation from the ground and the vegetation on it (GEIGER 1961). At each of the two sites, K 11 and K 4, one hygrometer measured the relative

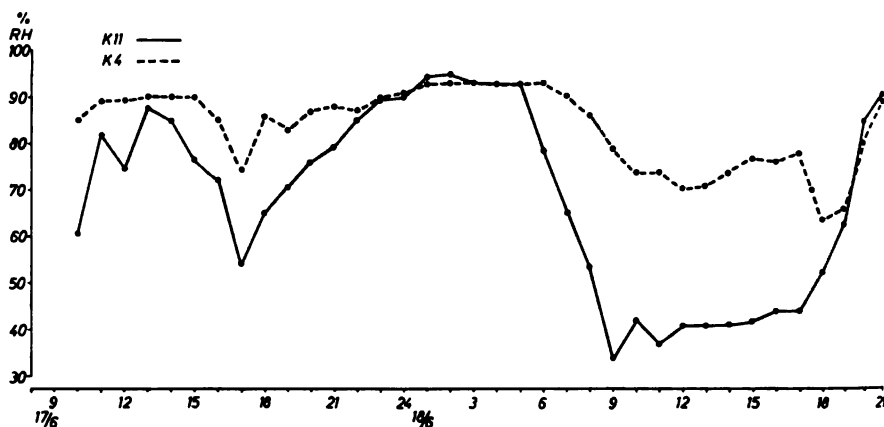


Fig. 9. The course of relative humidity at the ground.

humidity on the ground in the vegetation carpets and another hygrometer gave the values of the air at 50 cm above the vegetation (Figs. 9 and 10).

In rainy weather all the instruments showed high relative humidity. The short period of clear weather in the evening of June 17 was sufficient for drying. At K 4 the air had low humidity for a longer time than K 11, but the humidity in the vegetation remained high.

In the evening dew was formed and all the instruments showed maximum values. (The hair hygrometers had not the possibility of reaching the highest values of their scales. Probably many of the records during the night would have been 100 per cent.)

In the morning of June 18 the relative humidity decreased very rapidly and as early as 10<sup>00</sup> o'clock all the hygrometers showed about 40 per cent, except the one which was placed on the ground at K 4. The moss carpet and the dense vegetation retarded drying there. Also the humidity of the air at 50 cm was somewhat lower at K 4. In the evening, when the sun had reached the northern slope, humidity decreased at K 4, but never to less than 64 per cent in the vegetation. When the investigation was completed at 21<sup>00</sup> p.m., again all the hygrometers showed high relative humidity.

### Conclusions

This microclimatological investigation for a short period, but one with changing weather conditions, shows that the difference in the vegeta-

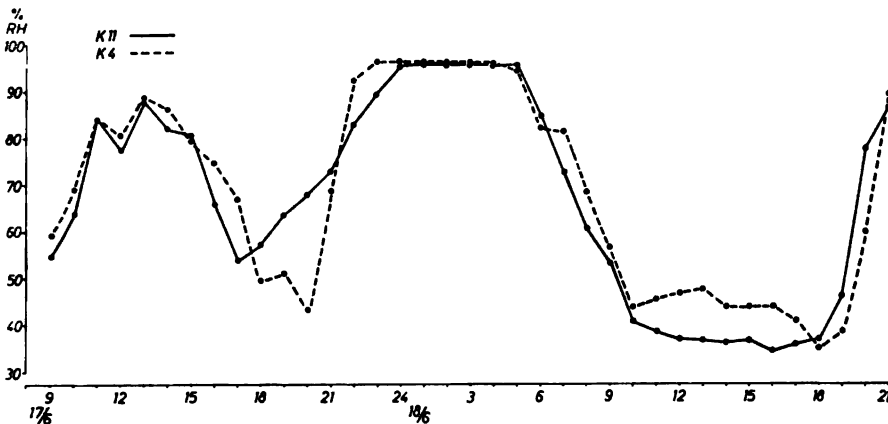


Fig. 10. The course of relative humidity at 50 cm above the ground.

tion of the southern and the northern slopes of Knivsås has an ecological correspondence. Later investigations also have confirmed the results of the measurements made in June 1964.

The different exposition of the slopes to sun rays results in different contributions of energy. This means on the southern slope higher temperatures producing a heat reservoir in the soil. In some respects this seems to be advantageous to the vegetation. Plants adapted to warmer and more continental climatic conditions are able to grow there. The vegetation period also is longer than on the northern slope. On the other hand, the vegetation on the southern slope is exposed to climatic extremes which are highly modified on the northern slope through the shelter of its vegetation. There some of the species also have a more maritime geographical distribution.

As an effect of these differences evaporation from the soil is greater on the southern slope. There the plants must endure drier conditions. This has been shown through investigations of the water content of the soil during two vegetation periods. Perhaps this also means that the leaching of the northern slope is stronger. Yet, until now very few indications of this have been shown on Knivsås. However, the differences in microclimate and, as a consequence thereof, differences in the water content of the soil are obvious. These ecological conditions must be of great importance for the formation of different vegetation types on the two slopes.

## Acknowledgements

The present investigation has been carried out at the Department of Plant Ecology (head: Laborator NILS MALMER) of the University of Lund. For advice and help in furnishing me with instruments I am indebted to Fil. lic. JAN O. MATSSON who also has critically discussed the results of the measurings. Docent ÅKE PERSSON has read the manuscript and given me valuable advice. The drawing of the diagrams has been carried out by Mrs. MIMMI VARGA. The investigation has been supported by grants from the Kungl. Fysiografiska Sällskapet, Lund, Kungl. Vetenskapsakademien, Stockholm and the University of Lund, for which I am sincerely grateful.

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## Måkläppens flora och vegetation

AV HENRIK JOHANSSON

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När LINNÉ besökte Falsterbo under sin skånska resa 1749 fanns inte Måkläppen utan bara Falsterbo rev om vilket han skriver: »... revet, som löper hela milen under vattnet uti sydost. Revet syntes här och där koxa utur vattnet. Förut har vuxit därpå mycken *Zostera*, och sjöfåglarne hava i otrolig myckenhet däruppå lagt sina ägg, men är nu mestadels bortskjöld av vattnet och vid blåsväder inunderas». Måkläppen växte upp ur havet igen och den förste som besökte ön i botaniskt syfte var ANDERS LIDBECK år 1794. Han uppger från ön: *Phragmites communis*, *Agropyron junceum*, *Elymus arenarius*, *Rumex maritimus*, *Atriplex littoralis*, *Suaeda maritima*, *Salsola kali*, *Honckenya peploides* och *Cakile maritima*. Enligt LIDBECK skulle *Elymus arenarius* ha invandrat omkring 1770 till den då vegetationsfria ön.

I PAUL ROSENIUS' fågelskildringar från ön omtalas också ett antal växter. GERTZ (1933) nämner från en av dessa *Phragmites communis*, *Ammophila arenaria*, *Elymus arenarius*, *Honckenya peploides*, *Cakile maritima*, *Lathyrus maritimus*, *Geranium molle*, *Viola tricolor*, *Galium verum* och *Artemisia maritima*. Från andra böcker och artiklar av ROSENIUS kan denna lista kompletteras med *Carex arenaria*, *Rumex acetosa*, *Sedum acre*, *Potentilla anserina* och *Vicia cracca*. ROSENIUS uppger vidare, att vid 1800-talets mitt *Rosa* sp. och *Sambucus nigra* funnits på ön med en buske vardera och att *Artemisia maritima* fanns där redan på 1860-talet. Däremot anser han *Phragmites* vara en nykomling från 1920-talet samt *Lathyrus maritimus*, *Galium verum*, *Viola tricolor* och *Geranium molle* vara sena invandrare men något tidigare än *Phragmites*. Av intresse är att kring sekelskiftet verkar *Vicia cracca* och *Artemisia maritima*, som nu båda är borta, ej ha varit ovanliga.

Den första fullständiga inventeringen av öns flora gjordes av OTTO



GERTZ 1930—32 under fyra besök på ön i slutet av månaderna maj, juni, september och oktober. NILS SYLVÉN gjorde en ny inventering 21/7 1959. Trots otjänlig väderlek blev artlistan imponerande. Genom vänligt tillmötesgående från professor SYLVÉN har listan ställts till mitt förfogande för denna uppsats.

Under 1965 gjorde undertecknad en ny inventering genom besök på ön 15/5, 10/6 och 10/9. I nedanstående artlista över de av GERTZ, SYLVÉN och mig funna växterna följer nomenklaturen WEIMARCK (1963). I 1965 års inventering förekommer en frekvensangivelse där a=allmän, ta=tämligen allmän, r=sällsynt och mr=mycket sällsynt d.v.s. högst några individ av arten. I övrigt anger + att arten funnits vid tillfället ifråga medan — betyder att den saknats.

Artlistan föranleder några korta kommentarer. År 1965 påträffade jag ej *Calamagrostis epigejos* utan enbart hybriderna med *Ammophila arenaria*. 1959 var hybriderna vanligare än förstnämnda föräldraart (SYLVÉN muntl. meddel.). *Agropyron junceum* × *repens* var 1965 mycket mera frekvent än *A. junceum*. När LIDBECK 1794 fann *A. junceum* på Måkläppen var ön för övrigt den första växtplatsen i Sverige för arten. *Salix cinerea* förekom 1959 som en halvmeterhög buske (SYLVÉN skriftl. meddel.).

Förteckningen upptar för 1930—32 91 arter, medan artantalet 1959 och 1965 var 61 respektive 72. Sammanslås inventeringarna 1959 och 1965 uppnås 84 arter. Således har en obetydlig artminskning skett på ön. 33 arter från GERTZ' inventering har ej påträffats vare sig 1959 eller 1965 medan vid dessa båda senare 26 nya arter upptäckts på ön. Sammanlagda antalet arter angivna från ön sedan 1794 uppgår nu till 121. Dessutom har 2 hybrider antecknats från ön. Felbestämningar kan dock eventuellt föreligga hos GERTZ när det gäller de båda odlade *Hordeum*-arterna liksom i släktena *Schoenoplectus* och *Galeopsis*.

Stora förändringar har som synes skett i floran sedan GERTZ' inventering. Ön har även i övrigt ändrat utseende sedan dess, något som verkar ske kontinuerligt (GERTZ 1933 och BERGMAN 1960). Efter en yt-tillväxt 1925—56 verkar en minskning nu ske genom att havet tår på västsidan. En insjö fanns på 1930-talet liksom 1959 (GERTZ 1933. SYLVÉN muntl. meddel. och C. A. NILSSON fotografier) men var 1965 helt borta. Den snabba omdaning som ön är utsatt för, kan motivera en kortfattad skildring av vegetationen på ön 1965.

Från den centrala delen av ön utgår en revel i nordlig riktning, här kallad norra reveln, och en revel i sydlig riktning. Den senare böjer av åt öster och delar upp sig i två grenar, som båda i en vid båge böjer

av åt norr. Denna revel kallas här östra reveln. Mellan den centrala delen av ön och den senare revelns norra gren instänges en mycket grund bukt i vilken en viss slamavsättning skett.

Den östra revelns södra gren saknar vegetation fränsett enstaka exemplar av *Elymus arenarius* och *Salsola kali*. Den norra reveln och den norra grenen av den östra reveln uppvisar en ganska likartad vegetation. Ytterst på revlarna är den ganska gles men tättnar successivt mot ett i det närmaste slutet växttäckte. Längst ut på den norra reveln möter man kraftiga beständ av *Atriplex*-arterna *calotheca*, *latifolia* och *littoralis*. Sedan följer en dynvegetation, där *Elymus arenarius* dominerar, medan *Ammophila arenaria* här utgör ett underordnat inslag. Mellan strandrågsruggarna är *Salsola kali* vanlig liksom den mattbildande *Agropyron junceum*  $\times$  *repens*. Försätter man längs den norra reveln söderut tättnar vegetationen efterhand och bl.a. *Lathyrus maritimus* och *Sedum acre* tillkommer, den senare i mattor om ett par m<sup>2</sup>.

Dynvegetationen försätter på den centrala delens västra sida i form av en dynbrant och enbart kring sjömärket är *Ammophila arenaria* dominerande i denna. Här fanns också 1965 öns enda förekomst av *Galium verum*.

Ytterst på den centrala delens östra strand förekommer ett bälte av *Phragmites communis*. Där innanför finns en zon, där *Agropyron repens* eller *Solanum dulcamara* dominerar. Denna zon kan också saknas, varvid *Atriplex littoralis*-zonen följer direkt på bladvassbältet. Sedan förekommer på ett ganska stort område *Lepidium latifolium*. Där uppträder också beständ av *Descurainia sophia*, *Hordeum murinum*, *Urtica dioica* och *Solanum dulcamara*. Försätter vi zoneringen inåt land möter man den forna sjöbottnen, där *Agropyron repens*, fränsett *Atriplex littoralis*, är praktiskt taget allenarådande. Kvickroten uppträder här i en upprätt och en nedliggande form.

Utanför bladvassbältet förekommer i buktens norra del en svagt koloniserad strandängsvegetation, där *Puccinellia retroflexa* och *Spergularia marginata* dominerar. I denna ingår också *Scirpus maritimus* och *Aster tripolium*. Utmed buktens södra sida utanför den östra revelns norra gren är strandängsvegetationen nästan slutet. Här dominerar *Puccinellia retroflexa* och *Spergularia marina*. Vanliga växter är här också *Chenopodium glaucum*, *Tripleurospermum maritimum* och *Aster tripolium*.

Längst in i bukten finns en liten ö där ytterst på östsidan *Glaux maritima* dominerar. Sedan följer en zon av *Scirpus maritimus*. Förhärskande arter i nämnda lilla ös vegetation i övrigt är *Lepidium latifolium*,

*Potentilla anserina*, *Tripleurospermum maritimum* och *Rumex crispus*. Denna ö var 1965 Måkläppens enda växtplats för — förutom *Glauz maritima* — *Juncus ranarius* och *Eleocharis uniglumis*.

På själva Måkläppens revel intill den nyss nämnda lilla ön uppträder i bukten ytterst en zon av *Atriplex littoralis* följd av en *Tripleurospermum maritimum*-zon utanför själva dynerna med *Elymus arenarius*.

Utom floran måste också vegetationen på Måkläppen ha förändrats avsevärt sedan GERTZ' inventering. *Lepidium latifolium*, *Solanum dulcamara* och *Descurainia sophia*, som nu ej är ovanliga i den centrala delens vegetation, saknades då. Ej heller fanns då *Atriplex calotheca*, som 1965 var ganska vanlig i *Atriplex*-bestånden och *Sedum acre* som uppträdde mattbildande (fanns där dock kring sekelskiftet). Likaså saknades då de i strandängsvegetationen vanliga arterna *Aster tripolium*, *Spergularia marina* och *marginata*. Sannolikt kommer förändringar i vegetationen att ske också i framtiden. Vid fortsatt slamavsättning i bukten kommer strandängsvegetationen att sluta sig. Detta har redan mer eller mindre skett i buktens södra del. Samhället här liknar mest DAHLBECKS (1945) *Puccinellia retroflexa*-variant av *Spergularia salina* — Isozonen men kommer enligt samma källa att utvecklas mot *Scripus maritimus*- och *Aster tripolium*-samhällen vid betesfred eller ett *Atriplex*-samhälle vid stark tångavlagring.

Sammanfattningsvis kan konstateras, att Måkläppens flora sedan 1930-talets början förlorat en tredjedel av sitt artbestånd. Denna förlust uppvägs dock av ett nästan lika stort tillskott av arter. Flera av dessa är nu typiska inslag i vegetationen.

Orsakerna till denna förändring är kanske svåra att fastställa. Bidragande orsaker kan dock ha varit att Måkläppen såväl till utseende som fågelfauna ändrats starkt (BERGMAN 1960). Gråtrutten har sålunda efter GERTZ' inventering ersatt skratmåsen och nått ett lika stort parantal. Att anställa jämförelser med förändringarna i floran på Gräsholmen utanför Bornholm (HANSEN, LARSEN & PEDERSEN 1965) visar sig svårt, då vegetationen på denna klippö verkar vara annorlunda. Detsamma är fallet med Dynan utanför Klagshamn. Sistnämnda ö, som varit föremål för ny inventering 1965, har i huvudsak strandängsvegetation (J. ERICSON muntl. meddel.).

#### Artlista

	1930—32	1959	1965
<i>Zostera marina</i> .....	+	+	ta
<i>Iris</i> sp. ....	+	—	—

	1930—32	1959	1965
<i>Juncus Gerardii</i> .....	+	—	mr
— <i>bufonius</i> .....	+	+	—
— <i>ranarius</i> .....	—	—	mr
<i>Phragmites communis</i> .....	+	+	ta
<i>Festuca rubra</i> .....	+	+	ta
— <i>arenaria</i> .....	+	+	—
— <i>arundinacea</i> .....	+	—	—
<i>Lolium perenne</i> .....	+	—	ta
<i>Poa annua</i> .....	+	—	ta
— <i>trivialis</i> .....	+	—	—
— <i>pratensis</i> .....	+	+	ta
<i>Puccinellia retroflexa</i> .....	+	+	ta
— <i>maritima</i> .....	+	—	—
<i>Dactylis glomerata</i> .....	+	—	r
<i>Avena sativa</i> .....	+	—	mr
<i>Holcus lanatus</i> .....	+	+	—
<i>Ammophila arenaria</i> .....	+	+	a
— — $\times$ <i>Calamagrostis epigejos</i> .....	+	+	r
<i>Calamagrostis epigejos</i> .....	+	+	—
<i>Agrostis stolonifera</i> .....	+	+	ta
— <i>tenuis</i> .....	—	+	—
<i>Bromus hordeaceus</i> .....	—	—	mr
<i>Triticum aestivum</i> .....	+	—	—
<i>Agropyron repens</i> .....	+	+	a
— <i>juncum</i> .....	+	+	r
— — $\times$ <i>repens</i> .....	—	+	ta
<i>Elymus arenarius</i> .....	+	+	a
<i>Hordeum vulgare</i> .....	+	—	—
— <i>distichon</i> .....	—	+	mr
— <i>murinum</i> .....	—	—	r
<i>Scirpus maritimus</i> .....	+	+	ta
<i>Schoenoplectus lacustris</i> .....	+	—	—
— <i>Tabernaemontani</i> .....	—	+	—
<i>Eleocharis uniglumis</i> .....	+	—	r
<i>Carex arenaria</i> .....	+	+	r
<i>Salix cinerea</i> .....	—	+	—
<i>Urtica dioica</i> .....	+	—	r
<i>Rumex tenuifolius</i> .....	—	—	mr
— <i>acetosella</i> .....	+	—	mr
— <i>crispus</i> .....	+	+	a
<i>Polygonum aviculare</i> .....	+	+	a
— <i>lapathifolium</i> ssp. <i>lapathifolium</i> .....	+	+	—
— — ssp. <i>pallidum</i> .....	+	—	—
<i>Chenopodium rubrum</i> .....	—	+	—
— <i>glaucum</i> .....	+	+	ta
— <i>album</i> .....	+	+	ta
<i>Atriplex latifolia</i> .....	+	+	ta

	1930—32	1959	1965
<i>Atriplex littoralis</i> .....	+	+	a
— <i>calotheca</i> .....	—	—	ta
<i>Salsola kali</i> .....	+	+	a
<i>Stellaria media</i> .....	+	+	a
— <i>apetala</i> .....	+	+	r
<i>Cerastium holosteoides</i> .....	+	+	ta
— <i>glutinosum</i> .....	—	—	mr
<i>Sagina procumbens</i> .....	+	—	—
<i>Honckenya peploides</i> .....	+	+	a
<i>Arenaria serpyllifolia</i> .....	+	—	—
<i>Spergula arvensis</i> .....	+	+	ta
<i>Spergularia marina</i> .....	—	+	ta
— <i>marginata</i> .....	—	—	ta
<i>Scleranthus annuus</i> .....	+	—	—
<i>Ranunculus sceleratus</i> .....	+	—	—
— <i>repens</i> .....	+	—	—
— <i>flammula</i> .....	+	—	—
<i>Papaver dubium</i> .....	+	+	mr
<i>Sinapis arvensis</i> .....	+	—	—
<i>Cakile maritima</i> .....	+	+	a
<i>Lepidium latifolium</i> .....	—	+	ta
<i>Capsella bursa pastoris</i> .....	+	+	a
<i>Cochlearia officinalis</i> .....	+	+	r
<i>Erophila verna</i> .....	—	—	ta
<i>Arabis thaliana</i> .....	+	—	—
<i>Descurainia sophia</i> .....	—	+	ta
<i>Sedum acre</i> .....	—	+	a
<i>Potentilla reptans</i> .....	+	—	—
— <i>anserina</i> .....	+	+	ta
<i>Trifolium repens</i> .....	+	—	ta
<i>Lotus corniculatus</i> .....	+	—	—
<i>Vicia hirsuta</i> .....	+	—	—
— <i>cracca</i> .....	+	—	—
<i>Lathyrus maritimus</i> .....	+	+	ta
<i>Geranium molle</i> .....	+	+	ta
<i>Viola tricolor</i> .....	+	—	—
— <i>arvensis</i> .....	+	—	—
<i>Chamaenerion angustifolium</i> .....	+	+	—
<i>Glaux maritima</i> .....	—	+	r
<i>Myosotis arvensis</i> .....	+	—	—
<i>Galeopsis bifida</i> .....	—	+	mr
— <i>tetrahit</i> .....	+	—	—
<i>Lamium amplexicaule</i> .....	+	—	—
<i>Stachys arvensis</i> .....	+	—	—
<i>Solanum dulcamara</i> .....	—	+	ta
— <i>lycopersicum</i> .....	+	—	—
<i>Linaria vulgaris</i> .....	—	—	r

	1930—32	1959	1965
<i>Veronica hederifolia</i> .....	—	—	r
<i>Plantago major</i> .....	+	+	r
— <i>maritima</i> .....	+	+	mr
— <i>coronopus</i> .....	+	—	—
<i>Galium uliginosum</i> .....	+	—	—
— <i>verum</i> .....	+	+	r
— <i>aparine</i> .....	+	+	r
<i>Sambucus nigra</i> .....	+	—	—
<i>Aster tripolium</i> .....	—	+	ta
<i>Gnaphalium uliginosum</i> .....	+	—	—
<i>Achillea millefolium</i> .....	+	+	—
<i>Tripleurospermum maritimum</i> .....	+	+	a
— <i>inodorum</i> .....	+	—	—
<i>Matricaria matricarioides</i> .....	+	—	—
<i>Artemisia campestris</i> .....	+	—	r
— <i>vulgaris</i> .....	—	—	r
<i>Senecio vulgaris</i> .....	+	—	ta
— <i>viscosus</i> .....	+	—	—
<i>Carduus acanthoides</i> .....	—	+	r
<i>Cirsium arvense</i> .....	+	+	mr
<i>Taraxacum</i> sp. ....	+	+	ta
<i>Sonchus arvensis</i> .....	+	+	mr
— <i>asper</i> .....	—	—	mr
<i>Hieracium umbellatum</i> .....	+	+	—

Dessutom har GERTZ och SYLVÉN antecknat följande varieteter och former:

	1930—32	1959
<i>Lolium perenne</i> f. <i>aristatum</i> .....	+	—
<i>Agrostis stolonifera</i> v. <i>maritima</i> .....	—	+
<i>Agropyron repens</i> f. <i>litoreum</i> .....	+	+
<i>Chenopodium album</i> v. <i>viridescens</i> .....	—	+
<i>Atriplex littoralis</i> v. <i>serratum</i> .....	+	+
<i>Galium verum</i> v. <i>litorale</i> .....	+	+
<i>Cirsium arvense</i> f. <i>jerox</i> .....	+	+

### Summary

Måkläppen is a small island outside Falsterbo in southernmost Sweden. The flora of vascular plants was investigated by OTTO GERTZ in 1930—32. New investigations were made by NILS SYLVÉN in 1959 and the author in 1965. At the end of the paper a list is given from these three investigations. Since 1794 121 spp. have been reported from the island. Most of the island is covered by sand dune vegetation. Where the drift from the sea remains *Atriplex* spp. are common. Along the shore of a cove on the east coast salt marsh is found.

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## Cytotaxonomical Studies in Some *Draba* Species

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### Introduction

The present account deals with the species *Draba nivalis* Liljebl., *D. fladnizensis* Wulf., *D. lactea* Adams, and, to a certain extent, with *D. norvegica* Gunn. It is based on personal observations from the central mountains of S. Norway, on observations communicated by Cand. Mag. TORSTEIN ENGELSKJÖN from a number of localities in Nordland and Troms, N. Norway, and on herbarium material borrowed from the Botanical Museums of the Universities in Bergen, Lund and Oslo, Naturhistoriska Riksmuseet, Stockholm, Tromsö Museum, and Det Kgl. Norske Videnskabers Selskab, Trondheim.

The aim of the present account has been to contribute to our knowledge of the above-mentioned species by cytological, ecological and morphological studies of Scandinavian material. New localities have been discovered since ELISABETH EKMAN (1926) and HULTÉN (1950) worked out maps showing the distribution of the species in Scandinavia. New distribution maps have, therefore, been worked out, of *D. nivalis* only for S. Scandinavia, partly after LID (in LAGERBERG et al. 1955, fig. 456, and 1959); of *D. fladnizensis* and *D. lactea* also from N. Scandinavia. Records of localities, on which the distribution maps have been based, are on file in the Botanical Museum of the University of Oslo. They include only localities of revised herbarium material. The material of the Institute of Systematic Botany of the University of Uppsala is revised by Mr. JAN BORG.

### Chromosome Numbers

Material for cytological examination has been provided partly in the field, partly in garden cultures. There are considerable technical difficulties in determining chromosome numbers accurately, especially in



the highly polyploid species. Meiosis is influenced by temperature, making flower buds of no use unless fixed in cool weather or early in the morning. The mitotic chromosomes tend to stick together. La Cour's chromic-osmium tetroxide fixative has given the best results in sectioned material, glacial acetic alcohol in squash preparations.

In all species the chromosomes, although varying somewhat in size, are rather small, isobrachial, and of the type generally found in the *Cruciferae*. The chromosome numbers in *Draba* form a polyploid series with basic number  $x=8$  ranging from the diploid  $2n=16$  to high polyploid  $2n=80-128$ . As yet, intraspecific polyploidy has not been demonstrated in the species under consideration.

*Draba nivalis* Liljebl.  $n=8$ . S. Norway, Lom, Höyrokampen, at 1440 m a.s.l. This number is previously found in plants from Torne Lappmark, Sweden (HEILBORN 1927), Clavering Island, NE. Greenland (JÖRGENSEN, SÖRENSEN & WESTERGAARD 1958), and from Alberta, Canadian Rocky Mts. (PACKER, in LÖVE & LÖVE 1961). *D. nivalis* seems to be a diploid species, uniform throughout its circumpolar range.

*D. fladnizensis* Wulf.  $n=8$ . S. Norway, Oppdal, Knutshö, at 1000 m a.s.l. — N. Norway, Troms, Överbygd, Bajit Riidagierdo, at 950 m a.s.l. This number is previously recorded from S. Norway, Oppdal, Kongsvoll (HEILBORN 1927), N. Iceland (LÖVE & LÖVE 1956), and NE. Greenland, Clavering Island (JÖRGENSEN, SÖRENSEN & WESTERGAARD 1958). The same number is known also in its Central European area, viz. from the Lechtaler Alps, Feuerspitze (MERXMÜLLER & BUTTLER 1964). Judged from its morphological uniformity it is probably an invariably diploid species.

*D. lactea* Adams.  $n=24$ . S. Norway, Oppdal, Storlidal west of Björnbekken (Skrufuren), at 1200 m a.s.l. — In material from N. Norway, Troms, Överbygd, Bajit Riidagierdo, at 1150 m a.s.l. the number could be estimated to  $n=ca. 24$ . Previously, this number has been recorded from NE. Greenland, Clavering Island (JÖRGENSEN, SÖRENSEN & WESTERGAARD 1958). From the few available data *D. lactea* seems to be hexaploid within its circumpolar area.

*D. norvegica* Gunn.  $n=24$ . N. Norway, Finnmark, Habavuoppebakte at Masi. HEILBORN (1927) reports this number in material from Greenland, and also (cf. EKMAN 1941) from S. Norway, Hardangervidda. Kisteskarndnut. FLOVIK (1940) found it in material from W. Spitsbergen. This variable species does not seem to vary in chromosome number, being hexaploid within the whole of its range.

### Morphological Variation and Distribution

EKMAN (1917, 1926) discusses extensively the morphological variation in *D. nivalis*, *D. fladnizensis*, and *D. lactea* (syn. *D. wahlenbergii* Hartm. f. *heterotricha* Horn.). Later (1932 b, 1933) she treats these species in Greenland, and finally (1941) the variable *D. norvegica* (syn. *D. rupestris* R. Br.) based on data from a large cultivated collection.

All *Draba* species are separated on quantitative characters showing great modifiability in different environments: size and outline of leaves and silicles, length of stems and pedicels, density of hair covering. Specimens from moist localities especially are often more or less glabrous (see fig. 2 c).

The hair type is a more reliable diagnostic characteristic distinguishing the species. Simple hairs, and the occurrence of a few bifurcate ones, are typical of *D. fladnizensis*. WEINGERL (1923) distinguished between the fine stellulate hairs of *D. nivalis* and the coarser stellate hairs found in *D. lactea* and *D. norvegica*. SCHULZ' (1927) monograph of the genus *Draba*, includes detailed diagnoses of the species, and surveys of their geographical distribution. The many varieties and forms, described and named (cp. EKMAN 1926 and SCHULZ op. cit.) give a clear picture of the great variability of the species. The characteristics on which we have chiefly based our herbarium revisions are summarized in the following.

*Draba nivalis* Liljebl. Plate I: 14—16, fig. 2 b. — EKMAN 1926, Plate 2. Leaves, stems and pedicels densely stellulate. Rosette leaves oblanceolate—lingulate, obtuse. Stems nude or unifoliate. Racemes usually elongated at fruit ripening, with glabrous, narrowly elliptic silicles, longer than the pedicels. Petals about 2.5 mm long.

*D. nivalis* is a well defined, arctic circumpolar species. It is weakly bicentric in Scandinavia (cp. HULTÉN 1950 and LAGERBERG et al. 1955 p. 198). In S. Norway (fig. 1) it has a distinct subcentre in Hardangervidda (LID 1959). Farther north, in the Jotunheimen—Vågå Mts. it has a density of localities, with a few isolated stations to the south, north and northwest. According to the collections in Herb. Oslo the northwesternmost stations in coastal direction are: Norddal, Daurmåls-  
haugen at Rendalsvann in Tafjord (O. DAHL 1893) and northwest of Grönvatn, 1450 m above sea level (S. LÖKKEN 1963) and Lesja, Grönhövis à vis Fallet at Kjölen (R. NORDHAGEN 1952) and Lesjaverk, Svartdal north of Valåvatn (R. NORDHAGEN & R. BERG 1957).

To the northeast, in the Dovre—Folldal Mts. it has scattered occur-

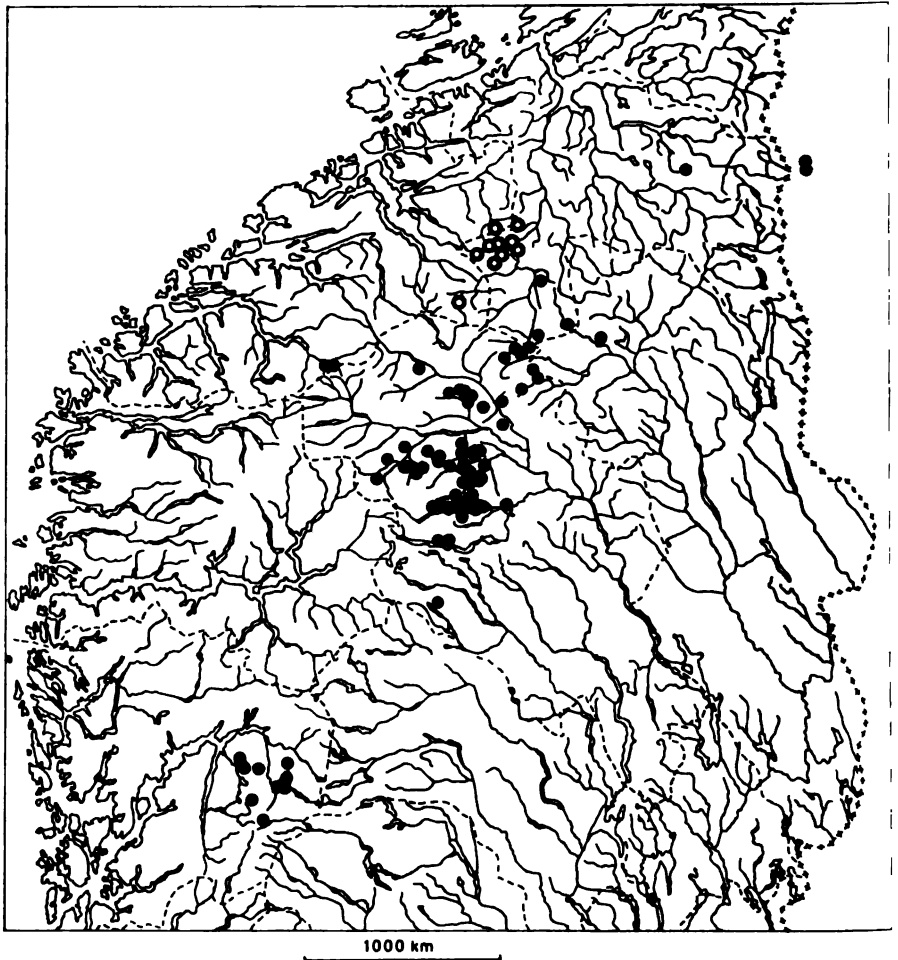


Fig. 1. Distribution in S. Norway and adjacent parts of Sweden of *Draba lactea* (○) and *Draba nivalis* (●).

rences, northwards to Veslekolla, 1320 m above sea level and the 1318 m top of Veslelgsjötangen (G. KNABEN 1964, 1966, Herb. Oslo). The northernmost locality in this area is probably Sisselhö in Oppdal. There are no herbarium specimens available of pure *D. nivalis* from this mountain. There are, however, specimens of *D. fladnizensis* × *nivalis* (J. LID 1946, Herb. Oslo), which indicate that the contingent parent species grow there. The northernmost locality of *D. nivalis* in S. Norway is Haltdalen, south of Bringen, 810 m above sea level (T. OUREN 1965.

Herb. Trondheim). — In N. Scandinavia it is distributed from south of the Arctic Circle (Lycksele Lappmark and Helgeland) to E. Finnmark.

*Draba fladnizensis* Wulf. Plate I: 8—12. Fig. 4 b. — EKMAN 1926, Plate 2. Rosette leaves narrow oblong-oblongeolate, acute or rather obtuse. Leaves prominently ciliate, laminae glabrous or with scattered simple and a few bifurcate hairs, especially on the ventral side of young leaves. N. Scandinavian plants, particularly, often glabrescent, with a few simple hairs at the leaf apices. Stems gracile, most often uni- or bifoliate, like pedicels and silicles completely glabrous. Silicles 6—10 or more, somewhat variable in shape: elliptic or ovate, longer than the pedicels, at ripening usually brownish violet with a metallic luster. Style not so conspicuous as in *D. lactea*, of the same breadth as the stigma. Petals 2—3 mm long. Raceme elongated at fruit ripening.

*D. fladnizensis* is an arctic-alpine species. It has been given as circumpolar. However, the distribution in arctic areas is obscure owing to confusion with *D. lactea*, cp. GJÆREVOLL (in GJÆREVOLL & SØRENSEN 1954).

In Scandinavia *D. fladnizensis* is distinctly bicentric (fig. 3). Since EKMAN (1926, p. 51) worked out its distribution, it has been discovered in several new localities. In S. Norway it has a centre in the Jotunheimen Mts. north and east to Lesja and N. Fron. To the south there are a few isolated stations in Valdres, Inner Sogn on the phyllites in Lærdal and Aurland (R. NORDHAGEN 1929, 1943, 1944, Herb. Bergen), and Finse-Upper Hallingdal. Its southernmost isolated occurrence is in the south slope of Mt. Hårteigen on Hardangervidda (G. KNABEN 1943, Herb. Bergen). North of Jotunheimen it occurs continuously in the schist area of the Folldal—Dovre—Trollheimen and Sunndalen Mts., westwards to Torsvatn in Skjåk (S. LØKKEN 1963, Herb. Oslo), northwards to the Soknedal—Budal—Kvikne Mts. (see map in GJÆREVOLL & SØRENSEN 1954).

Its range in N. Scandinavia has been displaced northwards both with regard to the southern and northern boundaries. The southernmost stations of true *D. fladnizensis* in Nordland are: Tysfjord: Noraldagvarre N. of Hellemofjord (S. SIVERTSEN 1964, Herb. Tromsø); Fjelldalen S. of Ridtaborre (O. SKIFTE & S. SIVERTSEN 1955, Herb. Tromsø).<sup>1</sup> Then

<sup>1</sup> In August 1966 it was found 30 km farther to the south, at Sildhopfjell in Nordfold, by T. ENGELSKJØN, O. SKIFTE, and H. SÆTRA. This locality is not marked on the map, fig. 3.

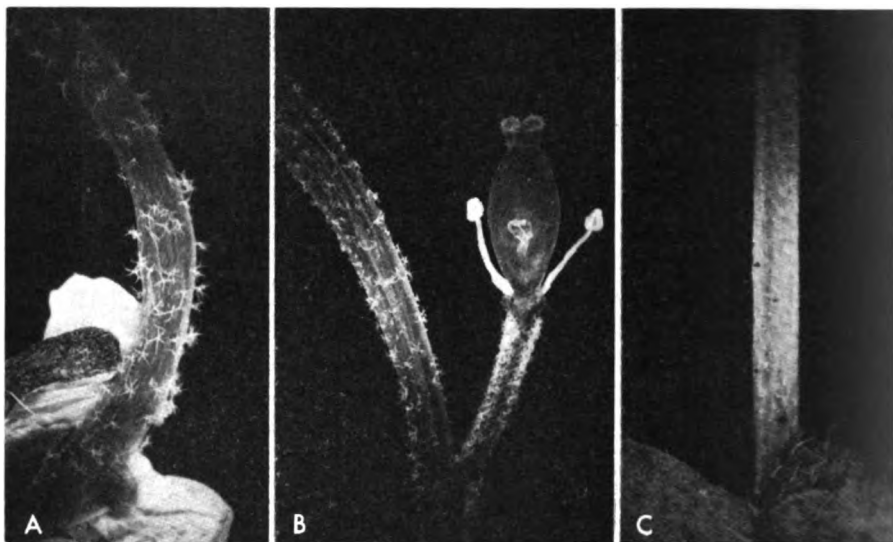


Fig. 2. Pubescence of stems in a) *Draba lactea*, frequent type with coarse stellate hairs. Troms: Bajit Riidagierdo. b) *D. nivalis*, normal type with stellulate hairs. Troms: Bægasangaissa. c) *D. norvegica*, type with entirely glabrous stem and glabrescent rosette leaves. Troms: Fløyfjell. 6×.

it is dispersed throughout Torne Lappmark and Inner Troms northwards to Kåfjord in W. Finnmark, and isolated in E. Finnmark: Lebesby, Eriksoivve, on dolomite gravel (L. R. RYVARDEN 1965, Herb. Tromsö).

*D. fladnizensis* × *nivalis* (*D. curtisiliqua* Zett.). Plate I: 13. — EKMAN 1926, Plate 2. Leaves oblanceolate, obtuse, stellate on both sides, densest on the ventral side, and with long, irregularly furcate hairs along the margin. Stems erect, gracile, stellate in the lower half. Silicles 2—4 mm long, with prominent style, always aborted.

Occurs frequently as richly flowering, branched clones among the contingent parent species.

As stellate hairs are absent in *D. fladnizensis*, one would expect the hybrid *D. fladnizensis* × *nivalis* to have the same kind of stellulate hairs as found in *D. nivalis*, but they are usually somewhat coarser, and with longer branches. HEILBORN (1927) has found the chromosome number  $2n=16$ , supporting the assumption of its hybrid origin. The genetics of the various types of hairs in the genus must be complex. Unfortunately, it seems impossible to raise  $F_2$  generations of this

hybrid, the specimens being seed-sterile. ZETTERSTEDT (see BLYTT 1876) found no seeds developed in 100 investigated specimens. In Greenland it is also sterile (JÖRGENSEN, SÖRENSEN & WESTERGAARD 1958).

*D. lactea* Adams. Plate I: 1—6. Figs. 2 a, 4 a. — Ekman 1926, Plate 2. Rosette leaves elliptic-linear, acute-attenuate, entire or with a couple of teeth, ciliate along the margins of long simple hairs. Laminas with furcate and coarse stellate hairs concentrated on the ventral side of the apical part, dorsal side usually glabrous. Stems nude, seldom unifoliate, glabrous or with stellate hairs restricted to the basal parts, sometimes extending to below the raceme. Pedicels and silicles glabrous. Petals 3—4.5 mm long. Silicles 4—10, coarse, narrow ovate, in a short corymboid raceme. Generally it is shorter than in *D. fladnizensis* and *D. norvegica*, though in some specimens it can reach a length of 6 cm. Style short (0.5 mm), conspicuous.

*D. lactea* has a characteristic habit of growth. Especially those specimens growing in deep moss carpets develop a number of rosettes clustered together in flattened tufts, caused by the repeated dichotomous branching of the subterraneous stems (fig. 4 a). These branches are covered by leaf remains consisting mainly of the sharply pointed and lignified mid-nerves. In this respect *D. lactea* differs from *D. fladnizensis* and *D. norvegica*, which are more irregularly branched, the rosettes more fortuitously clustered.

ADAMS' original description does not mention the occurrence of stellate hairs either on the rosette leaves or on the stems. From ADAMS' Latin diagnosis the following is cited: "Folia erecta laxa lineari-lanceolata acuta utrinque attenuata, integerrima, supra fere glabra, subtus et ad marginem pilis simplicibus hispida . . .", and "Scapi numerosi ex eodem caespite, digitales erecte glaberrime, terminati corymbo racemosa abbreviato 5—10-floro glabro".

ADAMS' type locality is the shore of the Arctic Sea at the mouth of the river Lena. According to EKMAN (1932 b) there are authentic specimens of *D. lactea* from the Arctic coast of Siberia in the Herbarium De Candolle in Geneva, with stellate hairs on the laminas. Of more interest are the two specimens in Herbarium Moscow collected by ADAMS at the river Lena and labelled "*Draba lactea* mihi. Vid. Mém. Mosq. Tom V, num 12". According to NASAROV (1923—24, p. 342) these two specimens belong to ADAM' original collections from 1806. NASAROV discusses them as follows: "Sie (i.e. *D. lactea*) ist durch zwei Individuen vertreten, von denen das eine glatte Blütenschaften hat,

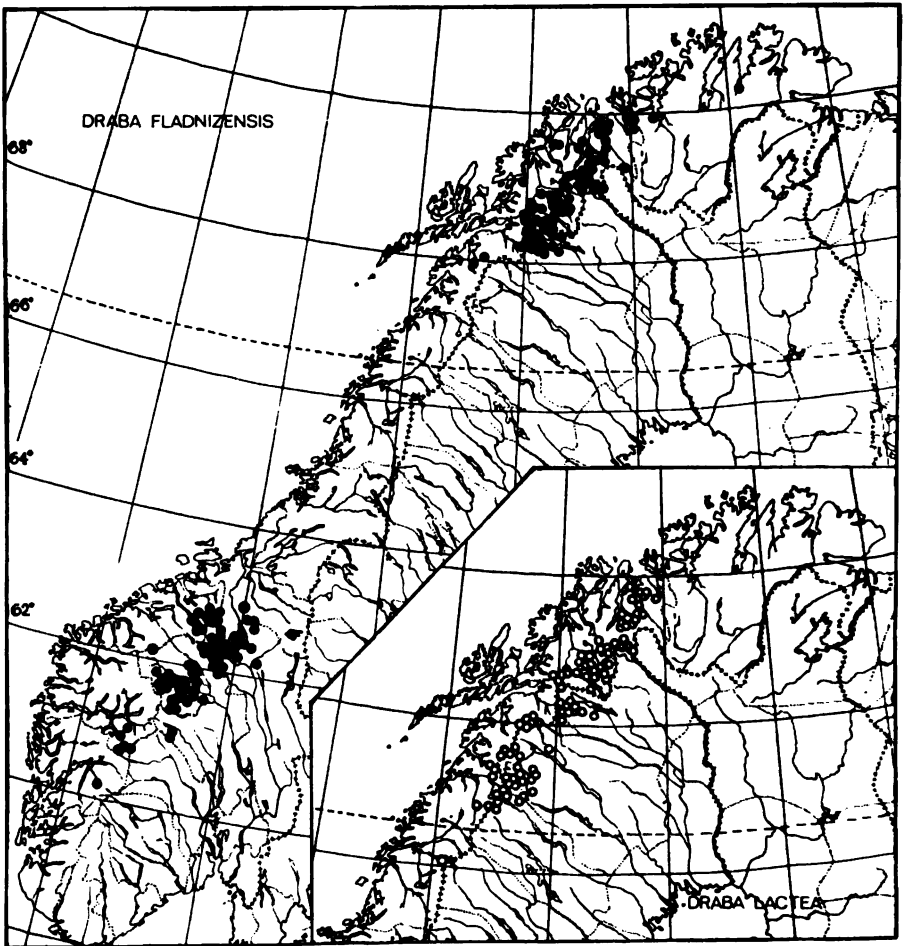


Fig. 3. Distribution in Scandinavia of *D. fladnizensis* (●) and in N. Scandinavia of *D. lactea* (○).

das andere hat an der unteren Blütenschaft gabel-ästige Härchen. Bei beiden fehlen die Blätter an der Blütenschaft, die Kelchblätter sind nicht mit dichten ungeteilten Härchen bedeckt, die Schötchen sind kahl. der Griffel ist bemerkbar — 0.5 mm. Hierher gehören zwei dürftige Exemplare: 1) aus dem Herb. Hoffmann, No 4856 sub. n. "*Draba lactea* Ad.; ad mare glac." und 2) aus dem Herb. Trinius, No 384, mit demselben Namen und mit Bezeichnung der Fundstelle. Die Blätter der beiden Individuen haben ausser den ungeteilten Härchen auch ästige. Alles übrige ist wie beim Typus."



Fig. 4. a) *Draba lactea*. S. Norway, Trollheimen, Skrufluren. b) *Draba fladnizensis*. S. Norway, Dovre Mts., Knutshø. Approximately natural size.



With respect to all the morphological characters except occurrence of the stellate hairs, ADAMS' and NASAROV's descriptions fit the species with  $2n=48$  chromosomes which today is recognized as *D. lactea*, not with *D. fladnizensis*. Hairiness of the lower parts of the scapes is mentioned by NASAROV. The occurrence of stellate hairs on the stems is evident in many herbarium specimens from N. Scandinavia (fig. 2 a), according to EKMAN also from Greenland. SELANDER (1950 II, p. 88) states that this character can vary in one single individual, and is of no taxonomical significance. It is probable that different segregation patterns in the various gene complements in the polyploid species *D. lactea* could be the cause of this variation.

*D. lactea* is distinctly bicentric in Scandinavia (fig. 1 and 3). In S. Norway it has scattered localities in the Trollheimen—Sunndalen Mts. In N. Scandinavia it is scattered from Mieskattjåkko in Lycksele Lappmark and Solvågtind in Nordland northwards to Kvænangen in E. Troms. It avoids the lower coast mountains, and is especially frequent in the continental districts of Torne Lappmark and Inner Troms.

*D. norvegica* Gunn. Plate I: 7. Fig. 2 c. Characters distinguishing this species from the three others are: rosette leaves entire or serrate, variable in outline. Stems with 1—3 leaves, in small specimens usually nude. Leaves varying as to hairiness, with simple, bifurcate and coarse stellate hairs, usually only with a few simple hairs along the margins. not ciliate as in *D. lactea*. Stems usually with irregularly branched stellate hairs, sometimes quite glabrous or with a few, scattered hairs not especially on the lower parts. Silicles elliptic-ovate, 5—10 or more. in an elongated raceme much longer than in *D. lactea*. Silicles normally glabrous, in certain types densely stellate.

*D. norvegica* does not develop the characteristic dichotomous branching seen in *D. lactea*. The rosettes are few or solitary, larger specimens are irregularly branched.

*D. norvegica* coll. is the most common alpine *Draba* in Scandinavia. It is found at different altitudes, and occurs in a number of regional and local forms.

## Discussions

The earlier botanists were inclined to regard some of the variation in the *Draba* species as being caused by introgression, believing the species to outcross freely. ELISABETH EKMAN was much occupied by

this problem and holds (1932 a, p. 200) that in some arctic areas *D. fladnizensis* × *lactea* seems to be more common than its parent species, *D. fladnizensis*, which she holds, is seldom quite pure in these areas. As to fertility, she states, that *D. fladnizensis* × *lactea* within the arctic areas is mostly fertile.

However, in recent times it has also been held that the range of *D. fladnizensis* is difficult to ascertain in arctic areas due to transitional forms interlocking it with *D. lactea* (see HULTÉN 1958).

In our time, with better knowledge of the nature of polyploid species and their origins, one would rather hesitatingly take it for granted that the diploid *D. fladnizensis* and the hexaploid *D. lactea* are interfertile. An  $F_1$  hybrid being formed will surely be highly sterile and not a source for backcrosses and introgression. A probable relationship should be discussed in connection with the problem of origin and presumable progenitors.

The one common prominent feature connecting *D. fladnizensis* and *D. lactea*, the long cilies and occurrence of simple and bifurcate hairs on the blades, might be taken as a sign of relationship, with *D. fladnizensis* considered as one of the diploid ancestors of *D. lactea*.

From a revision of the available herbarium material I have come to the conclusion that the difficulties in the separation of *D. fladnizensis* and *D. lactea* are not caused by the obscuring of specific boundaries by transitional forms of hybrid origin, but by previous confusion due to the fact that the circumscription of them on morphological grounds has not been clear. Apparently, the variability in hairiness of leaves and stems, especially in *D. lactea*, has been a chief cause of the confusion.

EKMÁN (1933, p. 446) lists the localities from W. and E. Greenland of the supposed hybrid *D. fladnizensis* × *lactea*, among them five collections of J. VAAGE from E. Greenland in Herbarium Oslo. A re-evaluation of these five collections reveals that they are pure *D. lactea*, with characters within the range of variation of this species, being fertile with well developed silicles. Another collection, from Torne Lappmark (H. SMITH 1925, Herb. Stockh.) mentioned by EKMÁN (1926 p. 55) may also be *D. lactea*. The numerous collections of *D. fladnizensis* and *D. lactea* in the herbariums from Scandinavian and extra-Scandinavian areas indicate that the hybrid between them, if occurring, is rarer than previously believed.

When two species cross freely one would expect to find prospective hybrid specimens in adjacent localities where one of the species occurs

abundantly and the other is scarce, such as in Trollheimen, provided the parent species are more or less self sterile. EKMAN (1917, pp. 9—10) shows that the flower biology of the *Draba* species favours self pollination. The frequent occurrence of some hybrid combinations, e.g., that of *D. fladnizensis*  $\times$  *nivalis*, shows that cross pollination takes place. In sunny weather, even in low temperatures, there are always some flies about in the localities with these *Drabas*, even at high elevations. In my garden cultures, which included the species occurring in the Dovre Mts., some species outcross, others do not. This question is in need of further analysis.

*D. fladnizensis* and *D. lactea* were once joined under the name *D. Wahlenbergii* Hornem., including f. *homotricha* Lindbl. and f. *heterotricha* Lindbl., the former corresponding to *D. fladnizensis*, the latter to *D. lactea*. EKMAN (1933 b) settles the nomenclatural question, giving priority to the name *D. lactea* Adams. In her previous paper (1926) she used this name for a subalpine form of *D. fladnizensis*, or one having simple hairs both on leaf margin and blades.

The different forms of *D. fladnizensis* mentioned by EKMAN (1926). are not given with a geographical area. They vary as to hairiness and are either modifications induced by the environment or Mendelian segregates: f. *genuina* Busch is glabrous with ciliate leaves, f. *homotricha* (Lindbl.) Weingerl has simple and bifurcate hairs on the leaves, f. *glabrata* Busch is glabrous, and f. *nidificans* (Norman) Ekman is a stunted form showing nanism with hairiness as in f. *genuina*. The f. *suspecta* Ekman is the only one deviating from the specific diagnosis of *D. fladnizensis*: "Folia interior rosulae sterilis uno alterove pilo stellato praedita; caeterum ut in f. *homotricha*" (EKMAN 1926, p. 14, 1932 b, p. 432). The following can be cited in elucidation of this form (EKMAN 1926, p. 11): "Die Frage, ob einige vereinzelte Sternhaare einer echten *D. fladnizensis* angehören können, müssen wir leider als noch ungelöst betrachten. Vorläufig muss ich deshalb eine solche Form mit einigen Sternhaaren an der inneren Blättern der sterilen Rosette *D. fladnizensis* f. *suspecta* benennen." Later the author stresses that suspect individuals with stellate hairs can be confused with several other taxa such as *D. lactea*, *D. norvegica* or *D. siliquosa* hybrids. The conclusion is that either the diagnosis of f. *suspecta* does not agree with the type, or this form belongs to another species, not to *D. fladnizensis*. SCHULZ (1927 p. 373) mentions *D. fladnizensis* f. *suspecta* as a synonym of *D. lactea*.

ARWIDSSON (1943, pp. 210—211) discussing the relationship of *D. fladnizensis* and *D. lactea*, holds that specimens seen by him, with

stellate hairs which have been identified as *f. suspecta*, belong to *D. lactea*. This author verifies the identification to *D. lactea* of a collection of O. DAHL's from Trollheimen which EKMAN (1926) at first hesitatingly referred to this species, the first known record from S. Norway. The present chromosome count of  $2n=48$  in specimens from Storlidalen in Trollheimen, identical with those in O. DAHL's collection (Herb. Oslo), also, lends support to the determination of it to *D. lactea*.

The difference in ecology is one of the most important features separating populations of *D. fladnizensis* and *D. lactea*. In Trollheimen both species occur on the same mountains, but in quite different environments and plant communities. Both are basophilous, growing in open vegetation. While *D. fladnizensis* grows abundantly in fissures and on barren rocks, where the snow cover in winter is thin, *D. lactea* is confined to wet moss carpets on gravel with more snow protection, and is rather scarce. This was the case on Tyrikvamfjell (1100 m a.s.l.), likewise on Skrufluren in Storlidal, where the two species were growing under different moisture conditions only a few meters from each other, according to my observations in 1961.

Mosses are often intermingled among the rosettes of the herbarium specimens of *D. lactea*. Head curator Mr. PER STØRMER has kindly identified some of these, all belonging to the alliance *Tomenthypno-Dryadetum* (see HEDBERG et al. 1952): *Campylium stellatum*, *Dicranum fuscescens*, *Dicranum glaciale*, *Ditrichium flexicaule*, *Drepanocladus uncinatus*, *Hylocomium splendens*, *Timmia austriaca*, and *Tomenthypnum nitens*.

*D. lactea* has a wider distribution area than *D. fladnizensis* in N. Scandinavia. In the outer districts it is scarce, specimens therefrom showing signs of introgression with *D. norvegica* (e.g. in the coastal mountains in Tysfjord, Nordland). These two species, both hexaploid, could be expected to produce a more or less fertile hybrid promoting gene exchange in back-crosses. As to type of hairs, size of leaves and silicles, etc. they are closely related.

SELANDER (1950) gives *D. lactea* from the central "rich area" of SW. Lule Lappmark, ascending to 1460 m a.s.l., at lower levels mostly on moist screes and north exposed cliffs, in upper alpine levels on solifluction soil and high-alpine lithosol, also in south exposition. BENUM (1958) records it as basocole in Troms, from wet or moist, gravelly soil on ravines, talus slopes, rock ledges, gravelly patches on grassy hills and on solifluction terraces. TØRSTEIN ENGELSKJØN (1963, Herb. Tromsø) has found it at 1500 m a.s.l. on Mt. Kirkestind in Troms, that

is at its N. Scandinavian altitudinal limit, and considers it as most abundant in the middle alpine region.

On Pältsa in Torne Lappmark HEDBERG et al. (1952) gives it from the low-alpine and middle-alpine belts (900—1300 m above sea level) as calcicole. In 1965 ENGELSKJØN found it characteristic of the extensive solifluction slopes on the northern part of the mountain, especially frequent in *Luzula arctica* alliances.

The southernmost, isolated locality in S. Norway of *D. fladnizensis*, the southern declivity of Hårteigen in Hardangervidda, is situated in the area from where LID (1958) reports *D. nivalis* in several localities, and which harbours many bicentric species at their southern boundary of distribution in Scandinavia.

In N. Scandinavia its southern and northern limits are displaced northwards. ARWIDSSON (1943, pp. 210—211) states that the herbarium collections seen by him from Lule and Pite Lappmark and from Solvågtind in Nordland, recorded as *D. fladnizensis*, are *D. lactea*. In our revision of the herbarium material ENGELSKJØN and I found that several sheets with plants from Solvågtind were erroneously labelled *D. fladnizensis*, although showing no resemblance to this species in its stricter sense. They were re-identified as *D. lactea*, some of them as possibly *D. lactea* × *norvegica*. On account of this labelling Salten has erroneously been recorded as the southern limit of *D. fladnizensis* in N. Norway (cp. LID 1963). The southernmost locality now known is Sildhopfjell in Nordfold (see above). In Nordland county the species is rare, being confined to a few stations in the inner, northern districts in Tysfjord and Skjomen. In Troms BENUM (1958) records it as calcicolous, chiefly from dry lithosol on barren ridges, in chionophobous plant communities. It is, moreover, frequent also in the lower alpine region.

*D. nivalis* is as restricted in distribution as the two species discussed above. It is continentally accentuated, occurring in inland areas especially. In S. Norway this is very prominent, cf. map fig. 1. The northernmost localities in the Dovre Range, Veslkolla and Veslelgsjötangen are of particular interest. They are situated close to Knutshø, from where *D. nivalis* has not been recorded. It is, however, known from several mountains surrounding Knutshø to the NE, SE and SW. In the herbarium of Riksmuseet, Stockholm, is a sheet with a mixed collection of *D. fladnizensis* and *D. nivalis* (G. KNABEN determ. 1966), from: "Norvegia, Dovre, Kongsvold ad saxa. Juli 1870 legg. J. E. ZETTERSTEDT et J. A. O. WICKBOM." This should encourage botanists to search eagerly for *D. nivalis* on Knutshø, which harbours most of the southern uni-

or bicentric species in Scandinavia. Kongsvoll is situated at the foot of Knutshø, to the west.

Another important feature is the total absence of *D. nivalis* in the Trollheimen Mts. It is also seen that *D. lactea* replaces *D. nivalis* in this region, a feature discussed by GJÆREVOLL & SØRENSEN (1954). In the discussion of vicariism of different taxa in various subcentres, the peculiar differentiation of *Papaver radicum* must be mentioned. In S. Norway this collective species comprises a number of geographical races, distinct as to morphological characters and chromosome structure, as shown in experiments (KNABEN 1959):

*Papaver radicum* ssp. *ovatilobum* s.str. in the Dovre Range, ssp. *gjaerevollii* in Trollheimen, ssp. *oeksendalense* and ssp. *groevudalense* in the Sunndalen Mts., and, farther south, ssp. *intermedium* in Jotunheimen Mts. and ssp. *relictum* in Valdres-Sogn. These races should be considered as markers of the different sub-centres within the S. Norwegian range of the bicentric species. *P. radicum* is absent only in the southernmost sub-centre, i.e. Hardangervidda.

It is evident that the Trollheimen-Sunndalen Mts. must have been a centre of migration in late glacial times, provided the rich Dovre flora was being recruited from the west. During their eastward migration, some species, such as *Draba lactea*, apparently did not reach farther than to the Trollheimen area.

On the basis of distributional studies of the flora in Sogn, Western Norway, in areas with the highest precipitation in Scandinavia (KNABEN 1950), I concluded that it must be more difficult for a species to conquer new areas penetrating into a region with an old vegetation cover and a high degree of humification, than it is to maintain its existence in edaphically favourable localities, where it has an adaptive advantage, even if the climate changes unfavourably. If *D. lactea* migrated as far as the Dovre-Folldal Mts. it would certainly have been able to persist there even during post-glacial hot periods. There are moist irrigated slopes of the mountains e.g. of the Drivdal valley, which could have offered favourable conditions throughout the latest 10,000 years.

The dry Folldal Mts. where *D. nivalis* occurs, are situated in the rain shadow of the high mountains in the west. The ground is generally exceedingly dry, covered with *Cetraria nivalis*—*Alectoria ochroleuca* carpets with a vascular flora rather poor in species (RESVOLL-HOLMSEN 1914). *Draba nivalis* is restricted to the very summits of the mountains in fissures, barren ridges and lithosol, or in lichen-rich *Dryas-Kobresia*



heaths. On the top of Veslkolla the somewhat chionophilous *Sagina caespitosa* grows copiously on patches of frost upheaval alternating with rocky flats harbouring *D. nivalis*. On Råtåsjøhø at 1500 m *D. nivalis* grows abundantly also in the scattered green mats of *Silene acaulis*, intermingled between the leaves of this species. On Pigghetta it occurs in rock fissures and dense lichen mats together with *D. fladnizensis*, *Campanula uniflora*, *Taraxacum dovreense*, among others.

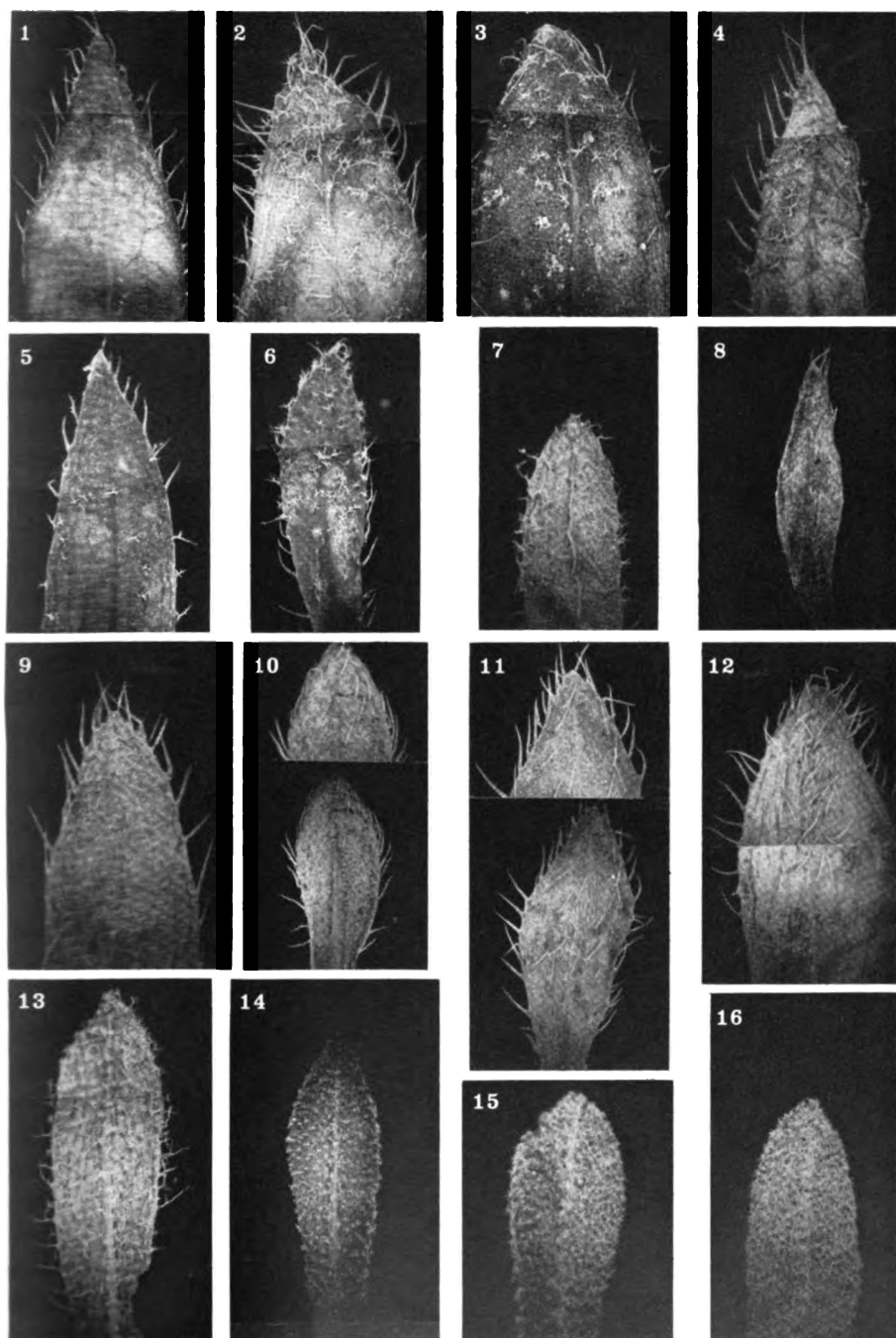
It seems probable that *D. nivalis* has reached the Dovre Mts. from the south or south-west, from a centre in the Jotunheimen—Vågå Mts. It seems that the species has not reached beyond the watershed in the Dovre Range, i.e. the ridges between the upper Drivdal Mts. and the Snøhetta massif. The occurrences are of relic nature, and the species has been crowded out in parts of its present range subsequent to the ripening of the vegetation cover.

The distribution centre in Jotunheimen of *D. nivalis* coincides with that of *Rhododendron lapponicum*, in S. Norway one of the most restricted of the bicentric species. Discussing its late glacial history, NORDHAGEN (1965) conjectures that it must have migrated from the west, and that present populations in Romsdal and Lesja, situated nearer the coast than the main Jotunheimen centre, may provide an indication of its migration route.

Similarly, *D. nivalis* has a few stations in a coastal direction from Jotunheimen (cf. map fig. 1, and listed stations above). These localities may also be taken as an indication of an eastward migration route from the coast in late glacial times.

GJÆREVOLL & SØRENSEN (1954) and GJÆREVOLL (1963) discussing phytogeographical problems in the central mountains of S. Norway find it difficult to relate the distribution of to-day of *D. nivalis* to a migration from the coastal zone, either to the southern subcentre. Hardangervidda, or to the more northerly Jotunheimen—Dovre Mts. They are inclined to agree with ELISABETH EKMANN (1926), who explains the curious distribution of this species, mostly on windswept, exceedingly dry localities on the mountain tops, by glacial age survival within the Jotunheimen—Dovre Mts. They believe that this species, and several other of the numerous problematic species, in S. Norway confined to mountains in some distance from the sea, persisted on nunataks rising above the inland ice, and that they did not manage to spread to a larger area after the retreat of the ice.

*D. nivalis* is a typical chionophobic species occurring in small populations often in south exposed localities with extreme temperatures.



Pl. I. Photos of rosette leaves. Magnification appr. 6×.

1—6. *Draba lactea*. 1. Dorsal side. Troms. Bajit Riidagierdo. 2. Ventral side. Troms, Bajit Riidagierdo. 3. Ventral side. Torne Lappmark, Pältsa. 4. Ventral side. W. Spitsbergen, Advent Fjord. 5, 6. Ventral sides. S. Norway, Trollheimen, Skrufluren. 7. *Draba norvegica*. Ventral side. Troms, Fløyfjell. 8—12. *Draba fladnizensis*. 8. Ventral side. Troms, Paras. Glabrescent type. 9. Dorsal side. S. Norway, Trollheimen, Tyrikvamfjell. 10. Ventral side. S. Norway, Trollheimen, Tyrikvamfjell. 11, 12. Ventral sides. E. Greenland, Myggbukta. 13. *Draba fladnizensis* × *nivalis*. Ventral side. S. Norway, Opdøl, Sisselthø. 14—16. *Draba nivalis*. Troms: Bægasangaissa. 14. Ven-





The ecological potentialities of such a species for glacial age survival are apparently great, on localities favourable as to snow conditions. GJÆREVOLL & SØRENSEN (loc. cit.) treat especially the possibilities for plant life during the last glaciation in Trollheimen where *D. nivalis* does not grow, but where several other species with uni- or bicentric distribution in Scandinavia have a common restricted area. In S. Norway, taxa such as *D. lactea* and the endemic *Papaver radicatum* ssp. *gjaerevöllii* do not occur outside this area.

It seems easier to explain the isolated occurrences to-day of the rare species in the Trollheimen—Dovre—Jotunheimen Mts. and Hardangervidda by nunatak survival, than only by survival on icefree strips of land along the coast. Much more research on different fronts is, however, needed before all the phytogeographical problems in these areas are explained satisfactorily.

### Summary

The species *Draba nivalis*, *D. fladnizensis*, *D. lactea*, and *D. norvegica* have been treated as to chromosome numbers, ecological and morphological variation, and geographical distribution especially in Scandinavia. The conclusion is that the diploid *D. fladnizensis* and the hexaploid *D. lactea* are well-defined species, not connected by hybridogenous forms and, further, that the arctic range of *D. fladnizensis* has not yet been determined satisfactorily due to confusion of this species with *D. lactea*, which has a wide range of variation, possibly due to its polyploid constitution.

### Acknowledgements

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## A List of Series and Species in the Genus *Cotoneaster*

By K. E. FLINCK<sup>1</sup> and B. HYLMÖ<sup>2</sup>

Our knowledge of the genus *Cotoneaster* has recently been increased considerably. On the one hand a number of new species have been described, and on the other, studies of heredity pattern and cytology within the genus have shown apomixis. The difficulty in treating the taxonomy of the genus is increased by the absence of a systematical division of the genus into sections and series. As a modern species list for the genus is missing we list below all the known species, systematically arranged in series.

SAX (1954) showed that a large number of *Cotoneasters* bred true if propagated from seed and that the offspring showed no deviations from the maternal parent, this being interpreted as apomixis. It was further found that a number of species were triploid with a chromosome number  $2n=51$ . SAX determined the chromosome numbers for 57 taxa of *Cotoneaster* and found 8 diploids, 43 triploids and 6 tetraploids. SAX also found that a number of species developed fruits and viable seed after having the flowers destyled. Studying the embryosac development, HJELMQVIST (1962) recently confirmed cytologically the occurrence of apomixis within the genus. The seven taxa investigated by HJELMQVIST were by far predominantly apomictic; only one of them, *C. roseus* Edgw., was occasionally amphimictic, while this may possibly be true also of two others, *C. nitens* Rehd. et Wils. and *C. soongoricus* (Regel) Popov.

BROERTJES (1956) could not confirm SAX' investigation. He found investigated *Cotoneaster* species to be diploid or tetraploid. Quite recently ZEILINGA (1964) in an important work has also questioned SAX'

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<sup>1</sup> AB Findus, Bjuv, Sweden.

<sup>2</sup> Nordreco AB, Bjuv, Sweden.

chromosome determinations. ZEILINGA proved that *Cotoneaster* species are normally either diploid or tetraploid. Triploidy was only found in two cultivars and these showed a reduced fertility. ZEILINGA tested 38 taxa, of which 7 were diploid, 2 triploid and 29 tetraploid. It was further demonstrated that 10 cultivars within the *C. salicifolius* - *C. frigidus* groups were diploid.

Our own cultivation trials as well as our studies in commercial nurseries, prove that of the *Cotoneasters* possible to cultivate in Southern Scandinavia and in Central Europe the dominating majority of species breeds true. The only species we have noticed not to breed true after seed propagation are the following: *C. frigidus* Wall. ex Lindl., *C. salicifolius* Franch., *C. dammeri* Schneid. and *C. conspicuus* Marq. — all these belong to Sect. *Chaenopetalum*. It should, however, be pointed out that a significant number of *Cotoneaster* species are not hardy in Scandinavia and have, therefore, not been studied in culture after propagation from seed. We also suspect that *C. nitidifolius* Marq. does not breed true but we do not yet have positive proof.

KLOTZ (1963 a) has only noticed heterogeneous offspring for crosses between *C. frigidus* cultivars and for species closely related to *C. salicifolius*. On the other hand KLOTZ did not observe the normal sexual behaviour of *C. dammeri* or *C. conspicuus*, which, unfortunately, has resulted in the description of a number of obviously unnecessary species.

Our out-breeding species *C. frigidus*, *C. dammeri* and *C. conspicuus* are included in SAX', BROERTJES' and ZEILINGA's diploids. SAX could not, on the other hand, determine with accuracy the chromosome number for *C. salicifolius*, but the closely related species *C. glabratus* Rehd. et Wils. and *C. henryanus* Rehd. et Wils. are, according to SAX, diploids. We have not had the last two species in cultivation. ZEILINGA showed *C. salicifolius* to be diploid as well as a number of cultivars of this species.

*C. rugosus* Pritzel (*C. salicifolius* var. *rugosus* Rehd. et Wils.) on the other hand, was shown by SAX to be triploid and by ZEILINGA tetraploid. *C. rugosus* also breeds true in our sowings and is obviously apomictic. Interesting is an early notice by STAPF (1924) that *C. floccosus* (Rehd. et Wils.) Flinck et Hylmö sown in French nurseries did not give any variation. We have also found herbarium collections of this taxon uniform and the species is probably apomictic. Plants in general cultivation in Scandinavia and Central Europe under the name of *C. salicifolius* var. *floccosus* are, however, nearly always *C. salicifolius*. BROERTJES and ZEILINGA report *C. salicifolius* var. *floccosus* to be di-

ploid. After studies of living and dried material, which was kindly placed at our disposal, we consider the material of *C. salicifolius* var. *floccosus* that ZEILINGA has investigated, to be *C. salicifolius*.

Of SAX' other diploids we have never seen *C. acutifolius* Turcz. in cultivation while of *C. acuminatus* Lind. and *C. microphyllus* Wall. ex Lind. we have, unfortunately, observed so few plants in cultivation that no accurate conclusion could be reached. What is cultivated under the name of *C. acutifolius* is not the Mongolian species but taxa from Central and Southern China (FLINCK & HYLMÖ 1962). What we have seen under the name of *C. acuminatus* in culture has not been uniform but requires a closer study; ZEILINGA found his *C. acuminatus* tetraploid. In our opinion, a number of microspecies are joined under *C. microphyllus* (cp. KLOTZ 1963 b). We have determined ZEILINGA's (1964) tetraploid *C. microphyllus* to be *C. thymifolius* Baker (syn. *C. integrifolius* (Roxburgh) Klotz).

It is interesting that our splitting species are also amongst those that ZEILINGA has shown to be diploid. BROERTJES and ZEILINGA found, however, contrary to SAX, that *C. adpressus* was diploid. We do not have sowings of true *C. adpressus* and do not know if this species is constant when sown.

ZEILINGA's diploid cultivars of *C. watereri* is closely related to the diploid *C. frigidus*. Our observation that the majority of the *Cotoneaster* species in cultivation is uniform when sown, is in contrast to a common opinion amongst nurserymen in countries with a milder climate. These nurserymen generally believe that there is a frequent hybridization within the genus. In these countries, and not least in the British Isles, *C. frigidus* and *C. salicifolius* and crosses between these two species are very common in the nurseries, together with *C. dammeri* and *C. conspicuus*.

TURRILL (1950) discusses, when describing a taxon of the genus, "the notorious difficulty in the genus *Cotoneaster* to determine satisfactorily the limits of species". At that time, before the apomixis in the genus had been shown, there was not sufficient information to give full reasons for the limits of species: "since we do not know how far hybridization happens in the wild, how plastic individual plants are, or how much intraspecific genetic variation occurs, there results a frequent difference of opinion between "lumpers" and "splitters". Splitting in North America has been carried to much more extreme lengths in the allied genus *Crataegus* than in *Cotoneaster*".

We have a feeling that a detailed study of the genus *Cotoneaster* and



Fig. 1. Sect. *Cotoneaster* (*C. sp.n.*, Ser. *Zabelioides*).

a splitting into relatively easily separated microspecies ought to be valuable, both for the theoretical plant geography and for the horticulture. Many taxa within *Cotoneaster* have a very high horticultural value and are propagated and sold by nurseries in different parts of the world, not infrequently on a very large scale. Under the same species taxa are sometimes distributed, which horticulturally are very different. Such an example is *C. "horizontalis"* hort. with 3 or 4 microspecies under the same name, even if the practical horticulturist has tried to split them into varieties or cultivars.

From the point of view of plant geography it must be valuable that a genus like *Cotoneaster* can be split up. With a distribution centre for the genus in China and a concentrically diminishing number of species towards Europe and north Africa (BROWICZ 1959) it ought to be possible, with a more thorough knowledge of the variations, to contribute to the evaluation of the recent development and distribution speed of our present plant societies.

We have considered it necessary to work as much as possible with

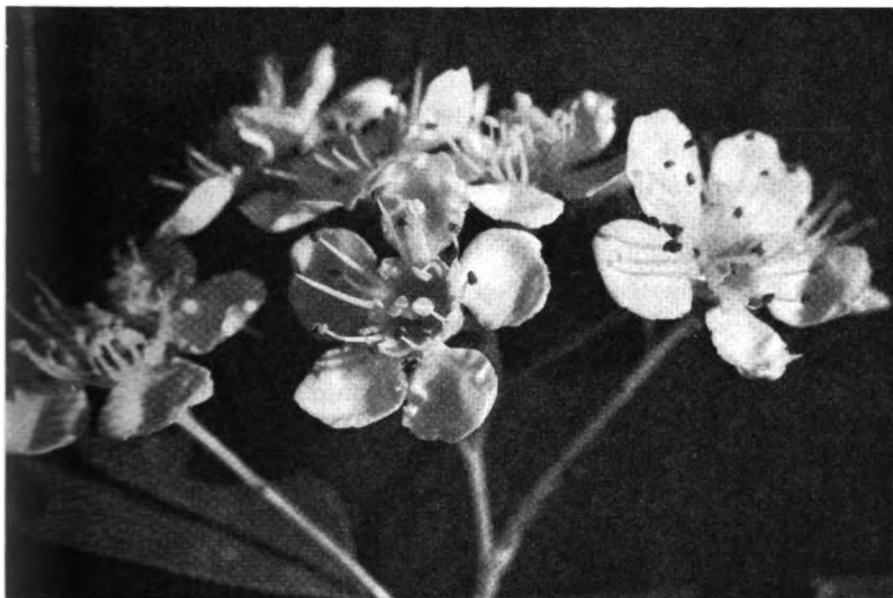


Fig. 2. Sect. *Chaenopetalum* (*C. calocarpus* (Rehd. et Wils.) Flinck et Hylmø).

living material, as differences between apomictic species within a genus like *Cotoneaster* often partly disappear in dried material. In cultivation such differences between microspecies can frequently be interpreted as significant macrocharacters. Furthermore, with seed propagation we obtain a control of heredity and can judge if a species breeds true or not.

### Sections, subsections, series and species

Realizing the difficulty which at present exists in obtaining a clear picture of the systematics of the genus we will, in spite of this, give a list of species where we try to group 174 species into 24 series. This list must, however, be considered preliminary, and we hope later to be in a position to make a revision. The difficulty for us originates in the fact that of several species we have not yet seen a representative specimen and we particularly lack material from the many species described by Russian taxonomists. As far as we know, no complete systematical list has been published at the present time, with the exception of REHDER's (1949) list of cultivated species. KLOTZ' (1957) careful



revision unfortunately lacks systematical grouping. Later KLOTZ (1963 a, b and c) thoroughly revised three groups of species.

KOEHNE's (1893) division of the *Cotoneaster* genus into two sections: *Orthopetalum* (= *Cotoneaster*) and *Chaenopetalum*, has been strongly criticized by some authors. KLOTZ (1963 a) considers that KOEHNE's division, based on the positions of the petals, is corresponding neither to natural relationship within the genus nor to international rules of botanical nomenclature.

YÜ (1963) proposed a division into the sections, *Densiflos*, *Cotoneaster* and *Uniflos*. We consider YÜ's division to be artificial in the highest degree and to have no foundation whatsoever with the natural relationship. A grouping of the species within the genus based on the number of flowers in the inflorescences leads to ridiculous consequences. So in Sect. *Uniflos* YÜ tries to bring together all species with solitary or sometimes 2—5 flowers in the cluster. The section is divided into two series, *Microphylli* and *Distichi*, which to us appear to be totally unrelated. Ser. *Distichi* seems very heterogeneous and contains, for instance, *C. uniflorus* Bunge placed by us in Ser. *Cotoneaster*, *C. horizontalis* Dcne. belonging to Ser. *Adpressi* and *C. rubens* W. W. Smith more related to Ser. *Distichi* in the original sense. Although YÜ places *C. uniflorus* in Sect. *Uniflos* he includes *C. integerrimus* in Sect. *Cotoneaster* because of the number of flowers in the inflorescences being 3 or more. Most authors agree on the very close relationship between these two species. Often *C. uniflorus* is treated as a variety of *C. integerrimus*. Several other examples could be mentioned to illustrate the artificial way in which YÜ's system divides the genus.

Therefore, in contrast to KLOTZ and YÜ we consider that KOEHNE's sections are natural and fully justified. They divide the genus *Cotoneaster* into two so well defined groups that we could very well accept the genus split into two genera based on this principle. The position of the petals is only one of the marks that differentiate the sections. A number of other characters could be mentioned and not least the flowering of the corymb extended or simultaneous (Figs. 1 and 2). Hybrids between the two sections have been reported on several occasions. However, we do not know of any positive case and consider reported hybrids between the sections not to be proved. All of our investigated cases have obviously been wrong.

One cause for the opinion that the borderline between KOEHNE's two sections should be undefined is probably the species with ascending petals like *C. armenus* Pojark., *C. zerauschanicus* Pojark., and *C. oli-*

Table 1. List of Series of Cotoneaster

Subsection	Series	Numbers of stamina	Numbers of pyrenae	Colour of fruit
<b>Sect. I. Cotoneaster</b>				
<b>A. <i>Adpressi</i></b>		10(—13)		
	1. <i>Distichi</i>		2—3	red
	2. <i>Adpressi</i>		2—3	red
	3. <i>Nitentes</i>		2—3	black
<b>B. <i>Cotoneaster</i></b>		20		
	4. <i>Lucidi</i>		2—3	red or black
	5. <i>Melanocarpi</i>		2—3	bluish black
	6. <i>Cotoneaster</i>		2—5	red
	7. <i>Acuminati</i>		2—5	red
	8. <i>Glomerulati</i>		4—5	red
	9. <i>Bullati</i>		4—5	red or purple
	10. <i>Franchetioides</i>		2—3	red
	11. <i>Zabelioides</i>		2	red
<b>Sect. II. <i>Chaenopetalum</i></b>				
<b>C. <i>Chaenopetalum</i></b>		20		
	12. <i>Multiflori</i>		1—2	red
	13. <i>Tomentelli</i>		1—2	purple
	14. <i>Racemiflori</i>		1—2	red or purple
	15. <i>Orbiculares</i>		2	red
	16. <i>Saxatiles</i>		2	purple or black
	17. <i>Insignes</i>		1—2	bluish black
	18. <i>Hebephylli</i>		1—2	purple
	19. <i>Chaenopetalum</i>		2	red or black
	20. <i>Salicifolii</i>		(3—)5	red
	21. <i>Pannosi</i>		2	red
<b>D. <i>Microphylli</i></b>		20		
	22. <i>Buxifolii</i>		2—3	red
	23. <i>Microphylli</i>		2—3	red
	24. <i>Marginati</i>		2—3	red

*ganthus* Pojark. POJARKOVA (1955) places the two first mentioned species in Sect. *Chaenopetalum*. After many years of observing cultivated specimens we have no hesitation to place these species in Ser. *Melanocarpi* within Sect. *Cotoneaster*.

Of Sect. *Cotoneaster* we have had the opportunity to study in culture and in herbaria the majority of the species. We do not, however, know the species within Sect. *Chaenopetalum* so well. Many of these species are not hardy in Scandinavia and type specimens hide frequently in herbaria, which have not been available to us. Species of which we have not seen material have been marked with an asterisk (\*) in the list of species. For Sect. *Chaenopetalum* we have followed KLOTZ (1963 a, b).

**Cotoneaster B. Ehrhart 1761****Sect. I. *Cotoneaster***

Syn.: Sect. *Orthopetalum* Koehne 1893

**Subsect. A. *Adpressi* Hurusawa 1943**

The subsection *Adpressi* is characterized by flowers with only 10 (—13) stamina. All other subsections within the genus *Cotoneaster* comprise species having (15—)20 stamina.

**Series 1. *Distichi* Yü 1954**

*C. nitidus* Jacques 1857

Syn.: *C. distichus* Lange 1882

\**C. forrestii* Klotz 1963

\**C. marquandii* Klotz 1963

\**C. nagaensis* Klotz 1963

*C. cordifolius* Klotz 1963

Syn.: *C. distichus* var. *parvifolius* Yü 1954

*C. verruculosus* Diels 1912

*C. cavei* Klotz 1963

\**C. sandakphuensis* Klotz 1963

*C. rubens* W. W. Smith 1917

*C. chengkangensis* Yü 1963

*C. sanguineus* Yü 1954

**Series 2. *Adpressi***

Frutices decidui; folia herbacea vel subcoriacea; inflorescentia 1—3-flora: stamina 10—13; fructus rubri; pyrenae 2—3 (—4).

Series *Distichi* Yü foliis coriaceis sempervirentibus ab ea serie differt.

Species typica: *C. adpressus* Bois in Bull. Soc. Bot. France 51: CXLIX. 1904.

*C. adpressus* Bois 1904

*C. subadpressus* Yü 1963

*C. duthieanus* Klotz 1963

Syn.: *C. distichus* var. *duthieanus* C. K. Schneider 1906

*C. apiculatus* Rehder et Wilson 1912

*C. nanshan* Mottet 1925

Syn.: *C. adpressus* Bois var. *praecox* Bois et Berthault 1918

*C. horizontalis* Decaisne 1877

*C. perpusillus* (C. K. Schneider) Flinck et Hylmō stat. nov. (*C. horizontalis* Decaisne var. *perpusillus* C. K. Schneider in Ill. Handb. Laubh. 1: 745, Fig. 419 e. 1906)

*C. divaricatus* Rehder et Wilson 1912

*C. ascendens* Flinck et Hylmō nom. et stat. nov. (*C. horizontalis* Decaisne var. *Wilsonii* Havemeyer ex Wilson in Bull. Arnold Arb. Ser. 3, 1: 68. 1927)

The close affinity of *C. apiculatus* to Ser. *Adpressi* does not seem to have been observed earlier. *C. apiculatus* is very closely related to *C. nanshan* and we have difficulties in separating the two species. For the present, however, we prefer to keep *C. nanshan* as a species of its own, awaiting results from the cultivation experiments in progress.

In the valuable review of *Cotoneasters* from the Eastern Himalaya, YÜ (1954) regards *C. adpressus* as a variety of *C. horizontalis*. Later, however YÜ (1963) changed his view on the interpretation of the concept of species range within the genus *Cotoneaster*, describing the new species *C. subadpressus*. This new species is closely related to *C. adpressus*, being a microspecies from Yünnan. *C. adpressus* was described from the province of Szechuan. We prefer to include the Himalayan collections mentioned by YÜ (1954) in *C. duthieanus*. The sexual behaviour of *C. adpressus* and its relatives has to be checked as ZEILINGA (1964) showed *C. adpressus* to be diploid.

Series 3. *Nitentes* Flinck et Hylmō, ser. nov.

Frutices decidui; folia herbacea; inflorescentia 3(—5)-flora; stamina 10 (—12); fructus atri ad atrorubri; pyrenae 2—3.

Series *Adpressi* colore rubro fructuum ab ea serie differt.

Species typica: *C. nitens* Rehder et Wilson in Sargent, Plant. Wilson. 1: 156, 1912.

*C. nitens* Rehder et Wilson 1912

*C. harrismithii* Flinck et Hylmō 1962

*C. taylorii* Yü 1954

*C. tenuipes* Rehder et Wilson 1912

With some hesitation we include *C. taylorii* and *C. tenuipes* in Ser. *Nitentes*. The species have, however, inflorescences of only a few flowers, mostly 3, and 10 or 10—12 stamina, as well as 2 pyrenae and black berries.

**Subsect. B. *Cotoneaster***

Syn.: Subsect. *Integerrimi* Hurusawa 1943

**Series. 4. *Lucidi* Pojarkova 1939**

- C. acutifolius* Turczaninov 1832
- C. konishii* Hayata 1913
- C. pekinensis* (Koehne 1893) Zabel 1898
- C. lucidus* Schlechtendal 1854
- C. villosulus* (Rehder et Wilson 1912) Flinck et Hylmö 1962
- C. ambiguus* Rehder et Wilson 1912
- C. foveolatus* Rehder et Wilson 1912

HURUSAWA (1943) divided this groups into two series, *Lucidi* and *Acutifolii*. We consider the seven mentioned species to form a rather homogeneous group of species and prefer to keep them in the first described Ser. *Lucidi*. However, with some hesitation we include *C. foveolatus*, as this species shows several characters indicating relationship with species within Ser. *Glomerulati*.

**Series 5. *Melanocarpi* Pojarkova 1939**

- C. melanocarpus* Loddiges 1830
- C. niger* (Wahlenberg 1820) Fries 1845
- C. laxiflorus* Lindley 1829
- C. commixtus* (C. K. Schneider) Flinck et Hylmö stat. nov.** (*C. melanocarpus* Lodd. var. *commixtus* C. K. Schneider in Ill. Hand. Laubh. 1: 752. 1906)
- C. chailaricus* (Klotz) Flinck et Hylmö stat. nov.** (*C. melanocarpus* *C. antoninae* Juzepczuk 1950  
Lodd. var. *chailaricus* Klotz in Wiss. Z. Univ. Halle, Math.-Nat. 6: 963. 1957)
- C. talgaricus* Popov 1935
- C. armenus* Pojarkova 1955
- C. zerafschanicus* Pojarkova 1955
- C. ignavus* E. Wolf 1907
- C. oliganthus* Pojarkova 1938

**Series 6. *Cotoneaster***

Syn.: Ser. *Integerrimi* Pojarkova 1939

- C. integerrimus* Medicus 1793

- C. cinnabarinus* Juzepczuk 1950
- C. uniflorus* Bunge 1830
- \**C. pojarkovae* Zakirov 1955
- C. humilis* Dunn 1924
- C. obtusisepalus* Gandoger 1875
- C. intermedius* Coste 1893
- C. tomentosus* Lindley 1821
- C. soczaviamus* Pojarkova 1955
- C. obovatus* Wallich ex Dunn 1921
- \**C. camilli-schneideri* Pojarkova 1955

Series 7. ***Acuminati*** Yü

- C. simonsii* Baker 1869
- \**C. khasiensis* Klotz 1963
- C. acuminatus* Lindley 1821
- C. mucronatus* Franchet 1890

Series 8. ***Glomerulati*** Flinck et Hylmö, ser. nov.

Frutices erecti, decidui vel semi-sempervirentes; folia herbacea vel subcoriacea; cymae parvae; flores minuti; receptaculum parvum, tomentosum; petala erecta; stamina 16—20; fructus parvi, globosi, rubri; pyrenae plerumque 4—5, raro 3.

Species typica: *C. glomerulatus* W. W. Smith in Not. Bot. Gard. Edinburgh 10: 21. 1917.

- C. cinerascens* (Rehder 1923) Flinck et Hylmö 1962
- C. glomerulatus* W. W. Smith 1917
- C. nitidifolius* Marquand 1930
- C. newryensis* Lemoine 1911

Ser. *Glomerulati* include species from the province of Yünnan in Southern China. In the description (MARQUAND 1930) *C. nitidifolius* is said to have only 2 pyrenae. We have found, however, that the berries of this species have 4 pyrenae — even the holotype (K).

Series 9. ***Bullati*** Flinck et Hylmö 1962

- C. bullatus* Bois 1904
- C. rehderi* Pojarkova 1955 (*C. bullatus* var. *macrophyllus* Rehder et Wilson 1912)
- C. moupinensis* Franchet 1886
- C. cornifolius* (Rehder et Wilson 1912) Flinck et Hylmö 1962
- C. obscurus* Rehder et Wilson 1912
- C. reticulatus* Rehder et Wilson 1912
- C. sikangensis* Flinck et Hylmö 1962

Series 10. *Franchetioides* Flinck et Hylmö 1962*C. franchetii* Bois 1902*C. wardii* W. W. Smith 1917*C. sternianus* (Turrill 1950) Boom 1957*C. amoenus* Wilson 1912*C. dielsianus* Pritzel 1900*C. elegans* (Rehder et Wilson 1912) Flinck et Hylmö 1962*C. splendens* Flinck et Hylmö 1964*\*C. fangianus* Yü 1963

We include *C. fangianus* in this series with some hesitation as we have seen no specimens of this newly described species.

Series 11. *Zabelioides* Flinck et Hylmö, ser. nov.

Frutices decidui, ramis graciliter arcuatis; folia herbacea; petala erecta vel subpatentia; pedicelli crassi; inflorescentiae multiflorae; stamina 20; fructus rubri; pyrenae magnae; numerus pyrenarum 2, raro 3.

Ab ea series Ser. *Cotoneaster* ramis crassioribus, petalis incurvatis, racemis paucifloris differt.

Species typica: *C. zabelii* Schneider in Ill. Handb. Laubh. 1: 749. 1906.

*C. zabelii* Schneider 1906*C. wilsonii* Nakai 1918*C. genetianus* Hurusawa 1943*C. gracilis* Rehder et Wilson 1912

*C. miniatus* (Rehder et Wilson) Flinck et Hylmö stat. nov. (*C. zabelii* Schneider var. *miniata* Rehder et Wilson in Sargent, Plant. Wilson. 3: 430. 1917)

*C. wilsonii* was described by NAKAI as being closely related to *C. racemiflorus* of Sect. *Chaenopetalum*. Even HURUSAWA (1943) included it in Ser. *Racemiflori*, dividing the species into two forms. Still KLOTZ (1963 a) relates *C. wilsonii* to *Racemiflori* and includes it in Ser. *Tomentelli*. We have seen the holotype (A) and paratypes (A and K) and without any hesitation relate *C. wilsonii* with *C. zabelii*. Ser. *Zabelioides* thus includes closely related species all native of the wintry North-eastern part of China and Korea, including the type locality of *C. wilsonii*, viz. Dagelet Islands east of the Korean peninsula. These small islands seem to be the easternmost outpost of the genus, the westernmost being Wales or Spain for *C. integerrimus*, Granada, Spain, for *C. granatensis*, or probably the Atlas mountains of Morocco, being the habitat of *C. atlanticus*.

Sect. II. *Chaenopetalum* Koehne 1893Subsect. C. *Chaenopetalum*

Syn.: Sect. *Racemiflori* Klotz in Wiss. Zeitschr. Univ. Halle. Math. Nat. 12: 756. 1963.

Species typica: *C. frigidus* Wallich ex Lindley in Bot. Reg. 15, tab. 1229. 1829.

Series 12. *Multiflori* Pojarkova 1939

*C. roseus* Edgeworth 1861

*C. multiflorus* Bunge 1830

\**C. submultiflorus* Popov 1935

\**C. pseudomultiflorus* Popov 1935

\**C. megalocarpus* Popov 1935

\**C. mongolius* Pojarkova 1955

\**C. meyeri* Pojarkova 1955

*C. calocarpus* (Rehder et Wilson) Flinck et Hylmō comb. nov.

(*C. multiflora* Bunge var. *calocarpus* Rehder et Wilson in Sargent, Plant. Wilson, 1: 170. 1912)

\**C. roborowskii* Pojarkova 1961

\**C. kaschkarovii* Pojarkova 1961

*C. przewalskii* Pojarkova 1961

*C. reflexus* Carrière 1871

*C. silvestri* Pampanini 1910 (Syn.: *C. hupehensis* Rehder et Wilson 1912)

*C. granatensis* Boissier 1838

*C. silvestri* was described as related to *C. integerrimus* and *C. zabelii* and has since been treated so. We have the holotype specimen at our disposal (SILVESTER no. 900 a: Hupeh, Monte Niany-niany, alt. 1950 m, VII. 1907 (FI)) and find it synonymous with *C. hupehensis*.

*C. przewalskii* was described by POJARKOVA (1961) as synonymous to *C. multiflorus* Bunge var. *calocarpus*. As holotype, however, POJARKOVA did not choose the holotype of *C. multiflorus* var. *calocarpus*, which is WILSON no. 4015 from Szechuan (A) but a specimen collected by G. POTANIN in SE Kansu (LE). We have a specimen from Kansu collected by D. HUMMEL (no. 5154, Sept. 9, 1930 in Da-chu-Kuo ad Tan-chang, in prato silvatico ad pedem montis, ca 600 m.s.m. Frutex 1.5 m altus (S) which we want to identify as *C. przewalskii*. We feel that *C. przewalskii* and *C. calocarpus* are two distinct microspecies; we have both in culture.



Series 13. ***Tomentelli*** Klotz 1963*C. tomentellus* Pojarkova 1961\**C. tumeticus* Pojarkova 1961*C. soongoricus* (Regel 1873) Popov 1935\**C. allochrous* Pojarkova 1961*C. veitchii* (Rehder et Wilson 1917) Klotz 1957

With some hesitation we accept KLOTZ' (1963 a) Ser. *Tomentelli*. The number of species, however, has been strongly reduced. Thus, we prefer to include *C. potaminii* in Ser. *Hebephylli*, *C. silvestri* (*C. hupehensis*) in Ser. *Multiflora* and *C. wilsonii* in Ser. *Zabelioides* (Sect. *Cotoneaster*).

Series 14. ***Racemiflora*** Pojarkova 1939*C. atlanticus* Klotz 1963*C. racemiflorus* (Desfontaines 1829) K. Koch 1869\**C. transcaucasicus* Pojarkova 1961 (*C. obovatus* Pojarkova 1954 non *C. obovatus* Wallich ex Dunn 1921)\**C. karatavicus* Pojarkova 1961\**C. krasnovii* Pojarkova 1961*C. discolor* Pojarkova 1954\**C. schubertii* Klotz 1963*C. tauricus* Pojarkova 1938*C. persicus* Pojarkova 1954*C. ovatus* Pojarkova 1950*C. parnassicus* Boissier 1856Series 15. ***Orbiculares*** Klotz 1963*C. nummularius* Fischer et Meyer 1835*C. kotschyi* (Schneider 1909) Klotz 1963*C. orbicularis* Schlechtendal 1854*C. minutus* Klotz 1963Series 16. ***Saxatiles*** Pojarkova 1939\**C. saxatilis* Pojarkova 1938*C. nummularioides* Pojarkova 1954\**C. turcomanicus* Pojarkova 1961\**C. subarcutus* Pojarkova 1961\**C. morulus* Pojarkova 1961\**C. tythocarpus* Pojarkova 1961Series 17. ***Insignes*** Pojarkova 1939*C. insignis* Pojarkova 1939Syn.: *C. lindleyi* auct.

\**C. hissaricus* Pojarkova 1954

*C. suavis* Pojarkova 1954

*C. aitchisonii* Schneider 1906

*C. suavis* from Tadzhikistan (Hissar) seems to us very closely related to *C. aitchisonii* from Afghanistan. Having no comprehensive material available of *C. suavis* we prefer, for the present, to keep both species.

Series 18. *Hebephylli* Klotz 1963

*C. hebephyllus* Diels 1912

*C. monopyrenus* (W. W. Smith) Flinck et Hylmō nov. stat. (*C. hebephyllus* Diels var. *monopyrenus* W. W. Smith in Not. Bot. Gard. Edinb. 10: 27. 1917)

*C. majusculus* (W. W. Smith 1917) Klotz 1963

*C. incanus* (W. W. Smith 1917) Klotz 1963

*C. ludlowii* Klotz 1963

*C. microcarpus* (Rehder et Wilson) Flinck et Hylmō nov. stat. (*C. racemiflorus* (Desfontaines) K. Koch var. *microcarpus* Rehder et Wilson in Sargent, Plant. Wilson. 1: 169. 1912)

\**C. potaninii* Pojarkova 1961

*C. ludlowii* was described by KLOTZ (1963 b) as belonging to Ser. *Marginati* (Subsect. *Microphylli*). The species, however, diverges strongly from Ser. *Marginati*, for instance, by having only one pyrena. We have at our disposal an abundance of collections from Himalaya (BM) belonging to KLOTZ' species and we do not hesitate to include *C. ludlowii* in Ser. *Hebephylli*.

Series 19. *Chaenopetalum*

Syn.: Ser. *Frigidi* Yü 1954

*C. affinis* Lindley 1821

*C. obtusus* Wallich ex Lindley 1829

*C. bacillaris* Wallich ex Lindley 1829

*C. frigidus* Wallich ex Lindley 1829

*C. cooperi* Marquand 1927

Series 20. *Salicifolii* Yü 1963

*C. henryanus* (Schneider) Rehder et Wilson 1912

*C. salicifolius* Franchet 1886

***C. floccosus* (Rehder et Wilson) Flinck et Hylmö stat. nov.** (*C. salicifolius* Franchet var. *floccosus* Rehder et Wilson in Sargent, Plant. Wilson. 1: 173. 1912)

*C. rugosus* Pritzel 1900

*C. rhytidophyllus* Rehder et Wilson 1912

*C. dammeri* Schneider 1904

*C. morrisonensis* Hayata 1915

For the creeping species *C. dammeri* and *C. morrisonensis* KLOTZ (1963 b) formed a new Ser. *Radicantes* which was included in Subsect. *Microphylli* (KLOTZ' Sect. *Alpigeni*). Many marks like 5 pyrenae, type of leaves, flowers and habitus allow us, however, to consider them closely related to Ser. *Salicifolii*.

*C. dammeri* is one of the very few species shown by SAX (1954) and ZEILINGA (1964) to be diploid. In our experiment *C. dammeri* is not breeding true and we believe this species to have normal sexual behaviour. Awaiting cytological investigations and cultivation experiments, we prefer to consider the new species of KLOTZ (1963) *C. kweitschoviensis* and *C. radicans* as clones within *C. dammeri*; probably even *C. procumbens* Klotz (1957) will have to be included in *C. dammeri*.

Series 21. ***Pannosi*** Flinck et Hylmö, ser. nov.

Frutices erecti, sempervirentes; folia coriacea; stamina 20, fructus rubri; pyrenae 2.

Species typica: *C. pannosus* Franchet in Plantae Delavayanae 3: 221. 1890.

*C. glabratus* Rehder et Wilson 1912

*C. coriaceus* Franchet 1890

*C. lacteus* W. W. Smith 1917

*C. glaucophyllus* Franchet 1890

*C. harrovianus* Wilson 1912

***C. vestitus* (W. W. Smith) Flinck et Hylmö stat. nov.** (*C. glaucophyllus* Franchet var. *vestitus* W. W. Smith in Not. Bot. Gard. Edinburgh 10: 21. 1917)

\**C. insculptus* Diels 1912

*C. serotinus* Hutchinson 1920

*C. turbinatus* Craib 1914

***C. robustior* (W. W. Smith) Flinck et Hylmö stat. nov.** (*C. pannosus* Franchet var. *robustior* W. W. Smith in Not. Bot. Gard. Edinburgh 10: 21. 1917)

*C. pannosus* Franchet 1890

*C. crispii* Exell 1928

*C. crispii* was described as being a hybrid between *C. frigidus* and *C. pannosus*. However, in our experiments it breeds true (FLINCK & HYLMÖ 1964).

**Subsect. D. *Microphylli* (Yü) Flinck et Hylmō, stat. nov.**

Ser. *Microphylli* Yü in Bull. Brit. Mus. I, 5: 134. 1954.

Syn.: *Stirps* ("Strips") *C. microphylli* Baker in Saunders Refug. Bot. 1: Febr. 1869.

Gruppe *Alpigeni* Koch in Dendrol. 1: 175. 1869.

Sect. *Alpigeni* Hurusawa in Acta Phytotax. et Geobot. 13: 231. 1943.  
— KLOTZ (1963 b).

**Series 22. *Buxifolli* Klotz 1963**

*C. buxifolius* Wallich ex Lindley 1829

*C. lichiangensis* Klotz 1963

*C. hodjingensis* Klotz 1963

\**C. delavayanus* Klotz 1963

*C. brevirameus* Rehder et Wilson 1912

*C. rockii* Klotz

**Series 23. *Microphylli***

*C. conspicuus* Marquand 1937

Syn.: *C. pluriflorus* Klotz 1963

*C. permutatus* Klotz 1963

*C. nanus* Klotz 1963

*C. argenteus* Klotz 1963

*C. rotundifolius* Wallich ex Lindley 1829

\**C. cashmiriensis* Klotz 1963

*C. prostratus* Baker 1869 (*C. microphyllus* Wall. cv. 'Ruby' Boom 1959)

*C. congestus* Baker 1864

*C. thymifolius* Baker 1869 (*C. integrifolius* (Roxburgh 1932) Klotz 1963)

*C. microphyllus* Wallich ex Lindley 1827

\**C. cochleatus* (Franchet 1890) Klotz 1957

*C. elatus* Klotz 1963

*C. conspicuus* was shown by SAX (1954), as well as by ZEILINGA (1964), to be diploid. In our cultivation trials it does not breed true and we consider this species to have normal sexual behaviour. Await-

ing the results from cytological investigations and breeding experiments we prefer to reject several of KLOTZ' (1963 b) new species, which according to our opinion represent a normal variation within the species *C. conspicuus*.

We should also like to forward a note on a herbarium specimen (K) made by MARQUAND by which the black hairs on the under side of the leaves of *C. buxifolius* forma *melanotricha* Franchet in *Plantae Delavayanae* 3: 224. 1890, are caused by a fungus. The mentioned forma has thus to be rejected. In culture we have seen a large number of plants grown under the name of *C. microphyllus* f. *melanotricha* (Franchet) Handel-Mazzetti (syn. *C. cochleatus* f. *melanotricha* (Franchet) Klotz) which we consider as typical *C. microphyllus*.

Series 24. *Marginati* Klotz 1963

\**C. sherriffii* Klotz 1963

*C. schlechtendalii* Klotz 1963

*C. marginatus* Lindley ex Schlechtendal 1854 (*C. lanata* Jacques 1859)

\**C. meuselii* Klotz 1963

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## Studies in *Montia* L. and *Claytonia* L. and Allied Genera

### II. Some Chromosome Numbers

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In this paper I will give a preliminary report of chromosome numbers of some species within the genera *Montia* L., *Claytonia* L., *Naiocrene* (Torrey & Gray) Rydb., and *Montiastrum* (Gray) Rydb. The chromosome numbers (varying basic numbers) have proved to be of importance in these genera, particularly for their delimitation but also for the taxonomy within them. For this purpose the external morphology of the chromosomes is also significant.

Living plants or seeds for this investigation was received from colleagues in N. America and Europe. Particularly I am grateful to Miss PATRICIA KERN, Seattle, Dr. ALICIA LOURTEIG, Paris, Dr. J. A. CALDERS, Ottawa, and Dr. K. L. CHAMBERS, Corvallis. Much material I have also got from seeds in herbarium specimens. Some seeds and plants I have collected in Scandinavia and SE. Europe. The material has been cultivated in greenhouse in the Botanical Garden of Lund.

The determination of the chromosome numbers have been made in mitoses from root tips. Usually two preparations of five plants from every collection have been examined. The Svalöv modification of NAVASHIN-KARPECHENKO's fixative followed by a standard crystal violet staining with an addition of aniline have been used, without any pretreatments. The external morphology of the chromosomes was studied in squash preparations. The technique for this was described by ÖSTERGREN & HENEEN 1962 (*Hereditas* 48 pp. 332—341), it has been used with a few modifications; Carnoy (3 parts acetic acid + 2 parts absolute alcohol) was used instead of the special fixative recommended, and after staining the roots were placed in a 5 % pectinase solution for about one hour, the roots were pretreated for 3 hours with a 1.7 mM solution of 8-hydroxy-quinoline at 10°C.

Dried plant material and seeds are preserved at the Botanical Museum of Lund.

Table 1. Chromosome numbers in *Montia*, *Nalocrene*, *Montiastrum*, and *Claytonia*

Species	2n	Collections investigated
<i>Montia fontana</i> L. coll. ....	20	Sweden: Lapland, Tärna, Ö. NILSSON; Västerbotten, Umeå, Ö. NILSSON; Östergötland, Krokek, Ö. NILSSON; Västergötland, Dalum, Ö. NILSSON; Halland, Ölmevalla, Hästholmen, Ö. NILSSON; Skåne, Dalby, J. ERICSON; Skåne, Gladsax, Ö. NILSSON; Norway: Opland, Dovre, Dombås, Ö. NILSSON; Ostfold, Idd, Bakke, Ö. NILSSON; Faroe Isl.: Sandoy, E. KJELLQUIST; Iceland: Reykavik, Geysir, E. KJELLQUIST; Greenland: Unartoq Fjord, K. HANSEN et al.; Alaska: Kodiak Isl., SE. of Karluk, E. HULTÉN; Seward, Kenai Penins., J. A. CALDER.
<i>M. fontana</i> L. coll. ....	40	Sweden: Skåne, Baskemölla, Ö. NILSSON.
<i>M. minor</i> C. C. Gmel. ....	20	Sweden: Skåne, Dalby, Ö. NILSSON; Skåne, S. Mellby, Stenshuvud, Ö. NILSSON; Skåne, Ullstorp, Ö. NILSSON; Skåne, Gladsax, Bäckhalladalen, Ö. NILSSON; Denmark: Zealand, Amager, Ö. NILSSON; Bornholm, Rønne, Ö. NILSSON; Jutland, Skive, Ö. NILSSON; France: Haut Rhin, Bollweiler, C. SIMON; Italy: Calabria, Lago di Arvo, A. CHIARUGI et al.; Hungary: c. Vas, SE. of Örség, T. PÓCS; Yugoslavia: Serbia, Kriva Feja, H. RUNEMARK & Ö. NILSSON; Greece: Naxos, S. of Komiaki, H. RUNEMARK no. R-699; Australia: Victoria, Mt. Buffalo, near Chalet, F. N. HOBSON; New South Wales, Adelong, H. S. MAC KEE no. 7239.
<i>M. limosa</i> Decker .....	20	Sweden: Skåne, Limhamn, Ö. NILSSON.
<i>M. rivularis</i> C. C. Gmel. coll. ....	20	Belgium: Antwerp, from Botanical Gard.; Portugal: Coimbra, from Bot. Gard.; Greece: Ikaria, H. RUNEMARK; Mt. Olympos, Ö. NILSSON; Morocco: 10 km E. of Ifrane, N. ENGLESON.
<i>M. hallii</i> (Gray) Greene .....	20	Canada: B. C., Vancouver Isl., J. A. CALDER; B. C. Saltspring Isl., CALDER & MAC KAY; U.S.A.: Oregon, Benton Co., STEWARD; Washington, Seattle, P. KERN.
<i>M. linearifolia</i> Urv. ....	40	Kerguelen Isl., A. LOURTEIG; South Georgia: King Edward Cove, BONNER; Hestesletten, SMITH; Esmark Glacier, S. W. GREEN.



Species	2n	Collections investigated
<i>Naiocrene parvifolia</i> (Moç.) Rydb.	22	U. S. A.: Oregon, Corvallis, K. CHAMBERS; Oregon, Linn Co., E. of Foster, K. CHAMBERS; California, Fremo Co., QUIBELL; C a n a d a: B. C., SW of Hope, CALDER & SAVIL nr. 8371.
<i>N. flagellaris</i> (Bong.) Heller . . . .	44	U. S. A.: Alaska, Kuiu Isl., W. J. EYERDAM no. 7582; Washington, Seattle, P. KERN.
<i>Montiastrum dichotomum</i> (Nutt.) Rydb. . . . .	14	C a n a d a: B. C., Vancouver Isl., Mt. Newton, John Dear Park, M. C. MELBOURN.
<i>M. lineare</i> (Dougl.) Rydb. . . . .	28	U. S. A.: Washington Kittitas Co., between Easton and Cle Elum, P. KERN; Oregon, Grand Co., SE. of Dayville, A. CRONQUIST no. 7341; California, Shasta Co., W. of Platina, E. K. BALLS no. 11234; Washington, N. of Kettle Falls, BEAMISH & VRUGTMAN no. 60355.
<i>Claytonia cordifolia</i> S. Wats. . . .	20	U. S. A.: Oregon, Harney Co., Steen's Mt., K. CHAMBERS.
<i>C. sibirica</i> L. coll. . . . .	24	U. S. A.: Alaska, Kuiu Isl., W. J. EYERDAM; California, Mendocino Co., N. of Rock Port, E. K. BALLS no. 10579; C a n a d a: B. C., Englishmans River Park, W. of Parksville, M. C. MELBOURN; B. C., Pike Lake, T. TODD.
<i>C. sibirica</i> L. coll. . . . .	48	U. S. A.: Oregon, Jefferson Co., Black Butte, J. MORRIS JOHNSON no. 490; H o l l a n d: Utrecht, cult. in Cantons Park no. 610.
<i>C. spathulata</i> Dougl. in Hook. . .	48	C a n a d a: B. C., Vancouver Isl., Mt. Newton M. C. MELBOURN.
<i>C. perfoliata</i> Donn coll. . . . .	12	U. S. A.: Oregon, Jefferson Co., Black Butte, J. MORRIS JOHNSON; California, Monterey Co., MEEBOLD; C a n a d a: B. C., Cedar Hill, Vancouver, M. C. MELBOURN.
<i>C. perfoliata</i> Donn coll. . . . .	24	U. S. A.: California, Marine Co., HOWELL 1947.
<i>C. perfoliata</i> Donn coll. . . . .	36	U. S. A.: Washington, Chelan Co., S. of Wenatchee River, P. KERN; Oregon, Linn Co., E. of Foster, K. CHAMBERS; E n g l a n d, cult. in Chelsea Phys. Gard.; G e r m a n y: Oberhessen, Kr. Alsfeld, H. HUPKE; Bonn, cult. in Bot. Garden.
<i>C. gypsophiloides</i> Fisch & Mey.	16	U. S. A.: California, Sonoma Co., BENSON.

In the genus *Montia* the chromosomes are short and rod-shaped. The absolute length of the chromosomes varies in the diploid species ( $2n=20$ ) from 0.9 to 1.8  $\mu$  (in the tetraploid taxa they are somewhat smaller), in preparations made after the technique mentioned above.

In some species the longest chromosome in one set may be twice the length of the shortest. The chromosomes are usually  $\pm$  metacentric with a rather distinct centromere. The diploid species have all one pair of satellited chromosomes. This satellite is almost as broad as the chromosome body and is distinctly connected to the chromosome arm by means of a long coarse "stalk". The tetraploid *M. fontana* has two pairs of satellited chromosomes of the same size, while *M. linearifolia* has two pairs of different size. In *M. fontana*,  $2n=40$ , the four genomes are all very similar, but in *M. linearifolia* two are different from the others. The karyotypes of different species are often taxonomically valuable. The length and shape of the satellited chromosome compared to the rest of the chromosome set is easily observed and a useful character. In e.g. *M. fontana*,  $2n=20$ , the satellited chromosome is somewhat shorter than the longest of the other chromosomes, but in *M. minor* it is distinctly longer. In some species one pair of chromosomes is distinctly longer than the other. This long chromosome usually has another secondary,  $\pm$  terminal constriction. The karyotypes of different taxa in this genus will be described in a later paper. The chromosomes of *Montia* are similar to those of *Neopaxia* (cf. Ö. NILSSON 1966, p. 277) but somewhat longer. For *M. fontana* and *M. minor*  $2n=18$  has been reported previously, but this must be caused by some misinterpretation (cf. also MOORE 1963, p. 26). The basic number is 10.

The chromosomes of *Naiocrene* are very similar to those of *Montia* considering size and shape. In *N. parvifolia* one satellited chromosome pair has been noticed. Only chromosomes with a  $\pm$  median, distinct centromere have been observed, one pair has a secondary constriction. Compared to *Montia* the chromosomes are somewhat more uniform in length. The basic number is 11.

In *Montiastrum* the karyotype differs in many respects from those of preceding genera. The chromosomes are longer, about five times longer than those of *Montia*. In metaphase II they are often winding or bent in various directions. The centromere is in many pairs  $\pm$  subterminal. At least three of the longest chromosomes have a secondary constriction. In the diploid *M. dichotomum* one satellited pair has been observed. The satellite is distinctly thinner than the rest of the chromosome. The chromosomes within one set vary somewhat in length, the shortest is about  $\frac{2}{3}$  of the longest. The chromosomes of this genus resemble in their shape more those of *Claytonia* than those of *Montia*. The basic number is 7.

In *Claytonia* the chromosomes vary somewhat in size between dif-

ferent taxa examined. In comparison to those of *Montia* they are longer. In *C. perfoliata* ( $2n=12$ ) the chromosomes are in relative length about 7—9 times longer than those of *Montia*, and those of *C. cordifolia* are 12—15 times longer. The chromosomes are rod-shaped and much winding in metaphase II. The centromeres may be median but are usually placed in a  $\pm$  terminal position. In the diploid taxa only one satellited pair of chromosomes has been observed. The satellite is distinctly thinner than the rest of the chromosome. Most of the other chromosomes have a secondary constriction. The length of the chromosomes within one set varies much in some taxa, whereas they are  $\pm$  uniform in length in other taxa. In *C. perfoliata* ( $2n=12$ ) the longest chromosome is about twice the shortest, in *C. cordifolia* they are  $\pm$  uniform. In the length and shape the chromosomes of *C. cordifolia* resemble those of *C. sibirica*. On the other hand the chromosomes of the other species are similar, e.g. between *C. perfoliata* ( $2n=36$ ) and *C. spathulata* there is much resemblance. The chromosome numbers are known for rather many species within this genus. LEWIS (1962, pp. 918—928) and ROTHWELL (1959, pp. 353—360) reported aneuploid series for *C. virginica*, the chromosome numbers vary widely,  $2n=12$  to  $2n=72$  in some populations. DAVIS & BOWMER (1966, pp. 37—38) have obtained differing counts for e.g. *C. sarmentosa* C. A. Mey. ( $n=7, 8, 14$  and  $16$ ) from one single collection, and varying numbers in some collections of *C. lanceolata* Pursh and *C. virginica*. In their counts  $2n=24$  and  $16$  are the most usual diploid numbers. My counts  $n=10$  (*C. cordifolia*) and  $n=6$  (*C. perfoliata*) give haploid numbers not previously reported from this genus.

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## Smärre uppsatser och meddelanden

### Studies in *Montia* L. and *Claytonia* L. and Allied Genera, I. Correction and Additions

In the second fascicle of this journal 1966 (Bot. Notiser 119, pp. 266—285) I described the two new genera *Mona* Ö. Nilss. and *Paxia* Ö. Nilss. Dr. WALTER H. LEWIS, Missouri Botanical Garden, St. Louis, U.S.A., has drawn my attention to the fact that the latter is a later homonym of *Paxia* Gilg 1891, in Engler, Bot. Jahrb. 14, p. 320 and in Engler & Prantl, Nat. Pflanzenfam. II: 3, p. 70 (*Connaraceae*) and also to *Paxia* Herter 1931 in Estud. Bot. Reg. Urug. 4, p. 8, nom. nud. (*Euphorbiaceae*).

I now propose a new name:

***Neopaxia* Ö. Nilss. nom. nov.** (syn. *Paxia* Ö. Nilss., l.c. p. 274).

Type species *Neopaxia australasica* (Hook. f.) Ö. Nilss. comb. nov. (basionym *Claytonia a.* Hooker f. 1840 in Icon Plant.).

Recently I received some new collections of *Mona meridensis* (Friedrich) Ö. Nilss. from Caracas in Venezuela (VEN). I want to thank the direction of this herbarium and also Dr. VOLKMAR VARESCHI for making this material available to me.

The new collections are:

Venezuela, Est. Merida: Between Chachopa and Los Apartaderos, 13,000 feet, no. 55889, 1944; Laguna Mucubaji, 3750 m., L. ARISTEQUITA no. 921, 1952; Mucubaji, 3750 m., VARESCHI no. 2096, 1952 (isotype); Cerca Laguna Mucubaji, 3600 m., VARESCHI no. 7002 and no. 7119, 1958; Pico del Aquila, E. L. LITTLE Jr. no. 16288, 1954; Mucubaji, VARESCHI no. 8032, 1964; Laguna Anteogós, Massif del Pico Bolívar, Sierra Nevada de Merida, 4200 m., VARESCHI no. 7835, 1965.

The distribution of the species within the state of Merida in Venezuela is now known in more detail through these new collections.

On the labels of some of the specimens there is given some further information on the ecology and the mode of growth of this species. *Mona meridensis* grows in moist places around small pools, lakes or near springs, in a type of vegetation described by VARESCHI as *Epilobietum meridensis*. It reaches an altitude of 4200 m. The plants often form dense mats by their prostrate stems and branches. The flowers are noted to be cream coloured or whitish yellow and the leaves are membranaceous and often  $\pm$  reddish on ascending stems.

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## Litteratur

J. D. HOOKER: *The botany of the antarctic voyage of H. M. Discovery Ships Erebus and Terror in the years 1839—1843*. Under the command of Captain Sir James Clark Ross. — London 1844—1860. 3 volumes text (2224 pp.) + 1 volume atlas (528 plates). Facsimile edition (J. Cramer, Weinheim, Germany) 1963. Price DM. 960: —.

The 19th century saw many scientific voyages to unknown and at that time remote parts of the world. The British Erebus and Terror expedition to Antarctica and adjacent continents is known as one of the most important enterprises of this epoch. Its botanical results were published by JOSEPH DALTON HOOKER in a classical work, which, like many floras and monographs of the past century, has now become extremely rare. In 1960 a British bookseller offered a complete copy (including the coloured plates) at a price of £ 900. Among the many reprints of botanical works from the 18th and 19th centuries which have appeared during the last few years, the reissue of the "Erebus and Terror" should be mentioned as outstanding. This work is indispensable to all botanists working on the taxonomy and phytogeography of the southern hemisphere.

The reissue appears in a somewhat different form from the original edition. The text-volumes I. Flora antarctica (preceded by a "Summary of the voyage") (1847), II. Flora Novae-Zelandiae (1853—1855), and III. Flora Tasmaniae (1860) have been reduced to royal octavo size. The 528 plates, which in the first issue were contained among the three text-volumes, have been reproduced in the original quarto size and combined in one volume. The plates now appear in black-and-white. It is evident that this method has reduced the beauty of the coloured plates of the original work, but in general the reproductions can be considered good.

The bibliography of this work is somewhat involved. The years of publication quoted above, which appear on the title-pages, are partly misleading. Part I was issued in instalments between 1844 and 1847, part II in the same way between 1852 and 1855, and part III between 1855 and 1860. The differences can sometimes become important from a nomenclatural point of view. The exact dates of publication are quoted (compiled from various sources) in Flora Malesiana I, vol. 4<sup>s</sup> (1954) and in Taxon 14 (1965). An introduction containing some bibliographic and biographic information would have been a useful complement to the reissue of this magnificent work.

OVE ALMBORN

MASON E. HALE, Jr.: *A Monograph of Parmelia Subgenus Amphigymnia*. — Contributions from the U.S. National Herbarium 36: 5. Washington 1965. 168 pp., 16 plates, 29 figures (mainly distributional maps) in the text.

*Parmelia* has been considered as a fairly well known lichen genus in Europe (c. 75 species recorded, sec. POELT 1963) and in North America (c. 120 species, sec. HALE & CULBERSON 1960). Its main centres of distribution, however, are situated in tropical and subtropical areas. The total number of species, including *Hypogymnia* and *Menegazzia*, (which have often been treated as proper genera) has been estimated at c. 800. Many of them have been poorly known and often from the type locality only. A critical world monograph of this large genus has been eagerly desired by all lichenologists. The present volume by Dr. M. E. HALE (Smithsonian Institution, Washington, D.C., U.S.A.) deals with the subgenus *Amphigymnia*. It is proposed to be followed by revisions of the subgenera *Parmelia*, *Xanthoparmelia* (yellow species), and *Melanoparmelia* (brown species). HALE has completed a careful and well-written volume. No doubt, it is one of the most important contributions to lichen taxonomy in many years.

HALE has given a narrower delimitation to *Amphigymnia* than the one accepted by VAINIO and ZAHLBRUCKNER. So a considerable number of species have been transferred to the subgenera *Parmelia* or *Xanthoparmelia*. The *P. cetrarioides* group has not been included, as its position has not yet been determined. The total number of *Amphigymnia* species accepted amounts to 106 including 22 n.spp. described by HALE in the present volume. No subspecific taxa have been accepted. A considerable number of taxa have been reduced to synonymy. This is the result of a careful investigation of type specimens and other material from all important herbaria. The list of *nomina inquirenda*, where the type material has been too fragmentary for study or is presumably lost, is fairly short. On the whole, it seems probable that the nomenclature accepted by HALE will prove to remain stable.

Introductory chapters are devoted to morphology, chemistry and geographical distribution. HALE points out that the structure of the lower side of the thallus (especially the rhizines) and the "maculae" (= white spots in the upper cortex similar to pseudocyphellae) afford good specific characters. Much attention has been given to chemistry. A total of 23 lichen substances have been demonstrated in the 106 species. The structure of 8 of them is still unknown. "Chemical strains" have been found in several species, and their rôle as taxonomic criteria is discussed.

The descriptions of the species are fairly brief, but they seem to contain all essential data for the taxonomic delimitation. Each description is followed by a discussion of the systematic position of the species, and the decisive characters are appraised. The species concept seems to be well founded, mainly on characters from external morphology. Microscopical data from apothecia and spores are given, whereas few facts are quoted about the microscopical anatomy of the thallus, which is evidently of little use in the taxonomy of *Parmelia*.

To the merits of this book should be added that it is not encumbered with many "chemical species". In some cases, however, (*P. margaritata* - *P. arnoldii*,

*P. perforata* - *P. rigida*, and *P. xanthina* - *P. aberrans*) the specific delimitation has been founded on correlation in chemistry and geographical distribution within each pair of species. E.g., *P. margaritata* contains salacinic acid and is restricted to eastern North America, whereas the morphologically identical *P. arnoldii* has alecronic acid and is widely distributed in Europe and America (including eastern N. America). The reviewer would recommend that *P. arnoldii*, *P. rigida*, and *P. aberrans* be treated as "chemical strains" of *P. margaritata*, *P. perforata*, and *P. xanthina* respectively, as the distribution patterns are partly overlapping within each pair of species.

Artificial keys to the 106 species are given, often using distinctions as "medulla C+ red" vs. "med. C—" or "corticolous" vs. "saxicolous". There keys do certainly not claim to reflect any "natural system", but they are extremely useful as guides to the species. Several checks made by the reviewer showed that this approach is successful.

All of the material revised has been recorded in detailed lists of localities for each species. Further, the distribution of each species has been given in dot maps. Some areas, such as N. America, Africa and Japan, are well represented, whereas considerable gaps are found in S. America, Indonesia, China, and Australia. Several species have interesting patterns of distribution, often correlated with temperature and precipitation. Areas of other species, probably due to historical or propagative factors, are more difficult to explain.

OVE ALMBORN

D. D. AWASTHI: *Catalogue of the lichens from India, Nepal, Pakistan and Ceylon*. — Beihefte zur Nova Hedwigia 17. Weinheim (J. Cramer) 1965. 137 pp. Price DM. 40: —.

Although the first lichen from India was recorded more than two hundred years ago (LINNAEUS 1753), our knowledge of the lichen flora of this subcontinent is still fairly incomplete. Collections of Indian lichens, as a rule made by non-lichenologists, have been worked up by specialists in Europe. Several lists of localities have been published, and a considerable number of new species have been described, many of them known from the type collection only. Some scattered material is found in the monographic literature (e.g. *Acarospora*, *Cladonia*, and *Usnea*), but no effort at a Lichen Flora of India has ever been made.

Dr. D. D. AWASTHI (Dept. of Botany of the University, Lucknow, India), who has been working on Indian lichens for the last two decades, has issued a catalogue of all lichen species known from India including Nepal, Pakistan and Ceylon. This catalogue lists, alphabetically arranged, 158 genera and 1310 species. Several of the species are obviously synonyms, so that the real number of species recorded from India will amount to a lower figure. About half of the species listed were first described from India. In these cases, the location of the type material (usually in European herbaria), is indicated.

The work also includes a list of literature concerning lichens recorded from India. There is no taxonomic treatment of the material, except for some new combinations, which the author has considered as necessary in order to fit all species into the genera of ZAHLBRUCKNER's system. Whether or not such pre-

liminary combinations will gain acceptance will only become apparent on the appearance of a taxonomic revision.

The present volume is comparable to similar catalogues compiled for other areas, whose lichen flora is imperfectly known, e.g., Southern Africa (DOIDGE), Central America, Mexico and the West Indies (IMSHAUG), Argentina (GRASSI), and Chile (FOLLMANN). These afford valuable starting material for thorough taxonomic revisions, which must precede the issue of lichen floras of less known areas. To quote the words of J. D. HOOKER (Flora Indica, 1855): "The botanist should endeavour to determine how few, not how many, species are comprised in the flora of his district."

OVE ALMBORN

## Notiser

**Umeå universitet.** Till professor i ekologisk botanik vid Umeå universitet har från den 1 jan. 1967 utnämnts docent BENGT PETTERSSON, Uppsala.

**Lunds Botaniska Museum.** Till förste museiintendent vid Botaniska museet, Lund, har utnämnts docent OVE ALMBORN, Lund.

**Disputationer.** Vid Lunds universitet försvarade fil. lic. SUNE PETTERSSON den 7 maj 1966 avhandlingen: »Active and Passive Processes of the Sulfate Transport through Roots», fil. lic. SVEN-OLOV STRANDHEDE den 16 maj 1966 avhandlingen: »Studies in European Eleocharis, Subser. Palustres», fil. lic. BJÖRN E. BERGLUND den 17 maj 1966 avhandlingen: »Late-Quaternary Vegetation in Eastern Blekinge, South-Eastern Sweden. A Pollen-Analytical Study», fil. lic. STIG OLOF FALK den 21 maj 1966 avhandlingen: »Effect on Transpiration by Rapidly Changed Water Transport», och fil. lic. GERHARD HOLM den 15 sept. 1966 avhandlingen: »Studies in chlorophyll mutations in barley».

Vid Uppsala universitet disputerade den 21 maj 1966 fil. lic. GUNNAR WASSÉN på avhandlingen: »Gardiken. Vegetation und Flora eines lappländischen Seeufers».



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## Euryops in South West Africa

By BERTIL NORDENSTAM

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**Abstract:** Seven species of *Euryops* (*Compositae*) occur in South West Africa. Of these, *E. lateriflorus* (L.f.) DC. and *E. subcarnosus* DC. are widely distributed in southern Africa. The latter is commonly called *E. multifidus* (Thunb.) DC., which is a different species confined to the Western Cape Province. *E. asparagoides* (Licht. ex Less.) DC. has a disjunctive area with an outpost in South West Africa. *E. walterorum* Merxm. is a local endemic of the Great Gamsberg. *E. mucosus* B. Nord. sp. nov. is known from a single collection in southwest. It is allied to *E. dregeanus* Sch. Bip., a species of Namaqualand and Bushmanland recently found also in South West Africa. *E. namibensis* (Merxm.) B. Nord. stat. nov. is confined to the lower Orange River area, occurring on both sides of the river. The term "Gariep element" is suggested to designate a phytogeographical group of taxa with this type of distribution. Many species and even some genera belong to this element.

The genus *Euryops* (*Compositae*) is predominantly South African but has representatives also further to the north. Along the east of Africa it ranges as far as Ethiopia and Somaliland, and one species extends into southern Arabia. In the west, however, the genus reaches its northern limit in South West Africa (in the following abbreviated to SWA). Seven species of *Euryops* occur in SWA, two of which are not known outside the area.

### Key to the Species

- 1 a. Leaves all entire.
  - 2 a. Branches not ending as thorns. Leaves imbricated, flat, elliptic-ovate or obovate,  $1 \times 0.5$  cm. large or more. Involucre cup-shaped.
    - 3 a. Leaf-margins smooth. Heads radiate . . . . . 1. *E. lateriflorus*
    - 3 b. Leaf-margins ciliated. Heads discoid . . . . . 2. *E. walterorum*
  - 2 b. Branches divaricate, straight, ending as thorns. Leaves fascicled, linear-oblong, c.  $5 \times 1$  mm. large. Involucre narrowly campanulate with narrow base . . . . . 3. *E. asparagoides*

- 1 b. Leaves toothed, lobed or divided (some entire).
  - 4 a. Leaves oblanceolate—narrowly obovate, cuneate, flat, apically 3—5-toothed or -lobed (some entire), 3—9 mm. wide.
    - 5 a. Leaves powdery-tomentose, canescent ..... 4. *E. dregeanus*
    - 5 b. Leaves glabrous, bright green ..... 5. *E. mucosus*
  - 4 b. Leaves filiform—linear(—oblanceolate), 3—5-lobed or -partite (often some entire), glabrous; leaf segments 0.5—3 mm. wide.
    - 6 a. Leaves filiform or somewhat flattened, coriaceous, mostly 3-partite, sometimes entire or 5-partite, but not pinnately partite; leaf segments 0.5—1(—1.5) mm. wide, acute or distinctly mucronate ..... 6. *E. subcarnosus*
    - 6 b. Leaves linear, flat, carnose, mostly 3-partite, some entire and oblanceolate, some pinnatipartite with 2 pairs of lobes; leaf segments 1—3 mm. wide, obtuse or minutely apiculate ..... 7. *E. namibensis*

1. *E. lateriflorus* (L. f.) DC., Prodr. VI: 445 (1837).

This was first found in SWA in 1958, in sterile condition only. In 1962 I collected flowering material in the same area, and no doubt remains as to its identity. The species is widely distributed in South Africa.

**Distribution in SWA.** Lüderitz-Süd District: 10 miles S. of Witpütz, 1958, MERXMÜLLER 2380 leg. RUSCH & WISS (M); 8 miles S. of Witpütz, 1962, NORDENSTAM 1123 (LD); 11 miles S. of Witpütz, 1962, NORDENSTAM 1174 (LD).

2. *E. walterorum* Merxm. in Mitt. Bot. München II: 75 (1955).

The species is only known from the Great Gamsberg, where it was first collected by FLECK in 1891. It has the habit of *E. lateriflorus* but is more closely related to some other species, viz. *E. sulcatus* (Thunb.) Harv. and especially *E. empetrifolius* DC. The former is a rare species of the Roggeveld, and the latter, although extending westwards into the Roggeveld, has its main distribution area in the Orange Free State. The distributional gap between the closely related species, *E. walterorum* and *E. empetrifolius*, is thus comparable to the disjunction exhibited by *E. asparagoides* (see below).

**Distribution.** Rehoboth District: Gamsberg plateau; 1891, FLECK 157 a (Z); 1953, WALTER 4342 leg. SCHWERTFEGER (M); 1957, MERXMÜLLER 936 (M); 1963, NORDENSTAM 2391 (LD).

3. *E. asparagoides* (Licht. ex Less.) DC., Prodr. VI: 446 (1837).

The species was found in the Rehoboth District in 1949 and then regarded as new to SWA (SUESSENGUTH & MERXMÜLLER 1955 p. 74). It

was an interesting discovery, unveiling a disjunction of about 1000 miles between this outpost locality and the main distribution area in the Orange Free State.

However, the species had been collected in SWA once before, viz. by DINTER in 1911. He only found a single sterile specimen, which he described as *Othonna Schlechteriana* Dtr. A passage from his "Reiseberichte" (DINTER 1918 p. 60) is worth quoting in this connection:

"Und was wird das fernere Schicksal meiner neuen *Othonna Schlechteriana* (Dtr. 2184) sein? Einer meiner Nachfolger in der botanischen Erforschung D.-S.-W.-Afrikas wird die Pflanze in 10, 50 oder auch erst 100 Jahren nachentdecken, dann vielleicht aber blühend, und sie dann, da er sie nach der notwendigerweise unvollkommenen Beschreibung in meinem Katalog der bisher aus D.-S.-W.-Afrika bekannt gewordenen Pflanzen voraussichtlich nicht wiedererkennt, wieder als Novum neu benennen. Ohne zu ahnen, was für Kopfzerbrechen sie ihrem ersten Entdecker einst verursacht hat."

DINTER's name was validly published six years later (DINTER 1924 p. 316). The type specimen caused me some headache, too, until I realized its identity with *E. asparagoides* (cf. MERXMÜLLER 1965 p. 640).

**Distribution in SWA.** Rehoboth District: Kobus—Rehoboth, 1911, DINTER 2184 (B); Nauchas, 1949, STREY 2621 (BM, BR, K, L, M, PRE, SAM, SRGH).

4. *E. dregeanus* Sch. Bip. in Flora 28: 51 (1845).

Only recently found in the southernmost part of SWA. South of the Orange River it is distributed in L. Namaqualand and Bushmanland, extending southwards into the Vanrhynsdorp Division.

**Distribution in SWA.** Warmbad District: Farm Witpüts, 1963, MERXMÜLLER & GIESS 3627 (M).

5. *E. mucosus* B. Nord. sp. nov.

Holotypus: MERXMÜLLER 2378 leg. RUSCH & WISS (M). — Fig. 1, 2 F.

Affinis *E. dregeano* Sch. Bip., foliis glabris non canescentibus facile distinguitur.

Frutex ramosus 0.5 m. altus. Folia sessilia cuneata oblanceolata—anguste obovata glabra coriacea apice (2—)3(—5)-lobata vel -dentata, interdum integra apice rotundata. Involucri bracteae 8—10, basi connatae. Capitula radiata, pedunculi laterales erecti glabri. Achaenia oblongo-obovata dense villosa madefacta mucosa.

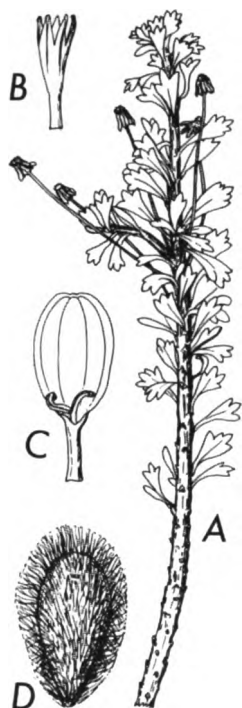


Fig. 1. *Euryops mucosus* — MERXMÜLLER 2378 (M). A: Portion of plant,  $\times 1/2$ . — B: Disc-floret, corolla,  $\times 5$ . — C: Ray-floret, corolla,  $\times 5$ . — D: Achene, soaked,  $\times 5$ .

A glabrous shrub, c. 0.5 m. high. Branches erect, leafy in the upper parts, naked below. Leaves closely set, erecto-patent—spreading, 1—2.5 cm. long, (2—)4—9 mm. wide, cuneate, oblanceolate—narrowly ovate, flat, glabrous, bright green, somewhat coriaceous, rugulose when dry, with a distinct midvein in the basal half (prominent on the abaxial side, finely sulcate on the adaxial side), (2—)3(—5)-lobed or -toothed at the apex; some entire, obtuse. Leaf-lobes broadly to narrowly ovate or narrowly oblong, 1—5 mm. long, 1—3 mm. wide, minutely apiculate with a white hard point. Peduncles lateral, erect—erecto-patent, 1—5 on one branch, 4—6 cm. long, c. 0.5 mm. thick, terete. Involucral bracts 8—10, basally connate, 4—5 mm. long, 1.5—2.5 mm. wide, 3—5-nerved, reflexed after fruiting. Ray-florets: tube 1.5 mm. long, cylindrical; lamina elliptic-oblong, 3.5 mm. long, 2 mm. wide, 4-nerved; style terete with swollen base; style branches 0.8 mm. long, obtuse. Disc-florets: corolla 3 mm. long, tubular at base, gradually widening upwards; lobes lanceolate, c. 0.8 mm. long, distinctly midveined, apically minutely papillate on the outsides; style terete with swollen base; style

branches 0.6 mm. long, truncate. *Pappus* unknown. *Achenes* oblong-obovate, 4 mm. long, 1.5—2 mm. wide, densely white-woolly, mucilaginous when soaked, with 5 longitudinal lines under the indumentum.

**Distribution.** L ü d e r i t z - S ü d District: 10 miles S. of Witpütz, 1958, MERXMÜLLER 2378 leg. RUSCH & WISS (M).

Only with hesitation I describe this as a new species, the material at hand being rather imperfect. It is out of flower, with only a few remaining achenes and florets (stuck in the mucus of the achenes). However, it falls definitely outside the variation range of any known species of the genus. The nearest ally seems to be *E. dregeanus* (see above). The leaves of the two species are quite similar in outline, but they are always densely canescent-tomentose in *E. dregeanus* and entirely glabrous in *E. mucosus*.

I have searched in vain for the species in the area where it was found, and it is to be hoped that some future collector will be more successful. This southern part of SWA is still insufficiently known, partly due to inaccessibility.

6. *E. subcarnosus* DC., Prodr. VI: 445 (1837).

This is the most widely distributed species of the genus in southern Africa, hitherto commonly known under the name of *E. multifidus* (Thunb.) DC. Unfortunately, THUNBERG's *Othonna multifida* is a different species, identical to *Lasiocoma petrophiloides* (DC.) Bol. The latter name has to be put into synonymy under *E. multifidus*. This species, which is not known from SWA, has a western Cape distribution, ranging from Hopefield and Malmesbury Division in the south to L. Namaqualand in the north.

The name *E. subcarnosus* DC. is available for the more widely distributed species. Its distribution range reaches northern SWA in the north and it extends into Bechuanaland and Lesotho (Basutoland) in the east.

The reason for this perennial name confusion is obvious. The two species are so closely similar as to be often indistinguishable without a close examination of the floral parts. The most reliable characters are the connate involucre bracts and the very long and fine (not mucilaginous) achene pubescence of *E. multifidus*.

In SWA *E. subcarnosus* is found in 'island' mountains of the coastal

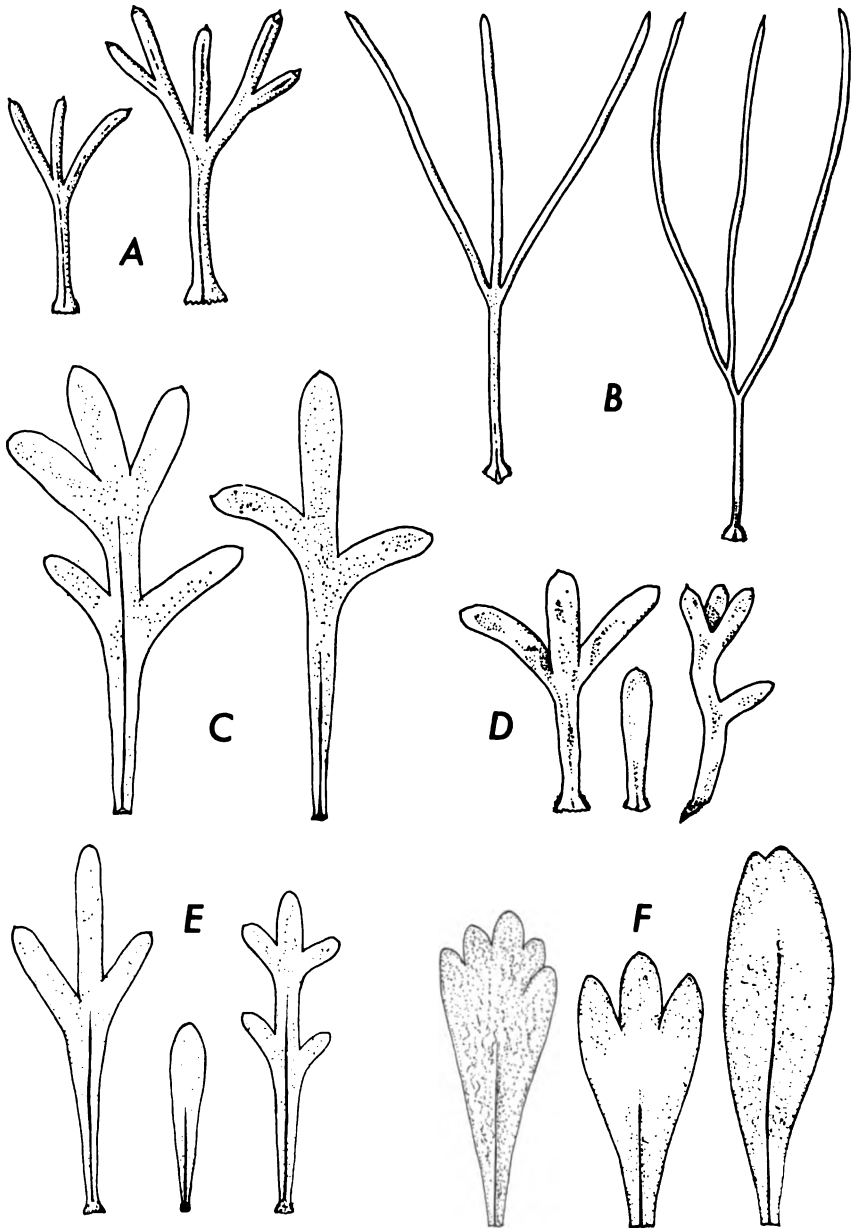


Fig. 2. Leaf shape,  $\times 2$ . — A—B: *Euryops subcarnosus*. — C—E: *E. namibensis*. — F: *E. mucosus*. — A: ÖRTENDAHL 58 (S). — B: DINTER 7904 (B). — C: NORDENSTAM 1176 (LD). — D: DINTER 6447 (M). — E: NORDENSTAM 1181 (LD). — F: MERX-MÜLLER 2378 (M).

Namib desert and in the stony semidesert of the Namib hinterland, as well as on mountains further inland (up to above 2500 m.s.m. on the Brandberg). The species exhibits considerable variation, which is partly due to the occurrence of polyploidy, but no attempt at an infraspecific taxonomy shall be made here. The leaf-shape is especially variable. Often the leaves are tripartite, but five-lobed and entire leaves also occur, often on the same specimen (cf. Fig. 2 A). Exclusively entire-leaved forms are not known within the area, nor any really 'multifid' forms with more than five leaf-lobes, but such forms occur in other parts of the distribution area. Particularly narrow-leaved forms occur in the Auas and Otavi mountains (cf. Fig. 2 B).

**Distribution in SWA.** Known from the following districts: Grootfontein, Omaruru, Windhoek, Rehoboth, Maltahöhe, Lüderitz-Süd, Bethanien, Keetmanshoop, and Warmbad (Map, Fig. 3).

7. *E. namibensis* (Merxm.) B. Nord. stat. nov.

**Basionym:** *E. multifidus* (Thunb.) DC. var. *namibensis* Merxm. in Mitt. Bot. München II:75 (1955).

**Holotypus:** DINTER 6447 p.p. (M).

This is a characteristic taxon occurring on both sides of the lower Orange River. The epithet "*namibensis*" is adopted, although the variety so named was originally differently circumscribed. Of the specimens cited by MERXMÜLLER in the original description only the holotype belongs here, and even this is somewhat 'atypical', compared to most other collections of the species. As a nomenclatural type it serves its purpose, however, and the creation of a new name is avoided.

It should be noted that the type number, viz. DINTER 6447, is a mixed collection. The sheet in M is, naturally, *E. namibensis*, whereas the material in GRA consists of *E. subcarnosus*.

Thus it seems that *E. namibensis* and *E. subcarnosus* grow together on the Buchuberge, like I have seen them growing together in some other localities. In these places the two species keep distinct, and no obvious intermediates have been found.

*E. namibensis* is best recognized by its flat leaves, some of which are pinnatipartite (Fig. 2 C—E), a type of leaf division never found in *E. subcarnosus*. *E. namibensis* is normally a showy plant with numerous capitula concentrated towards the end of the stems. The table below gives a comparison between some features in the two species.



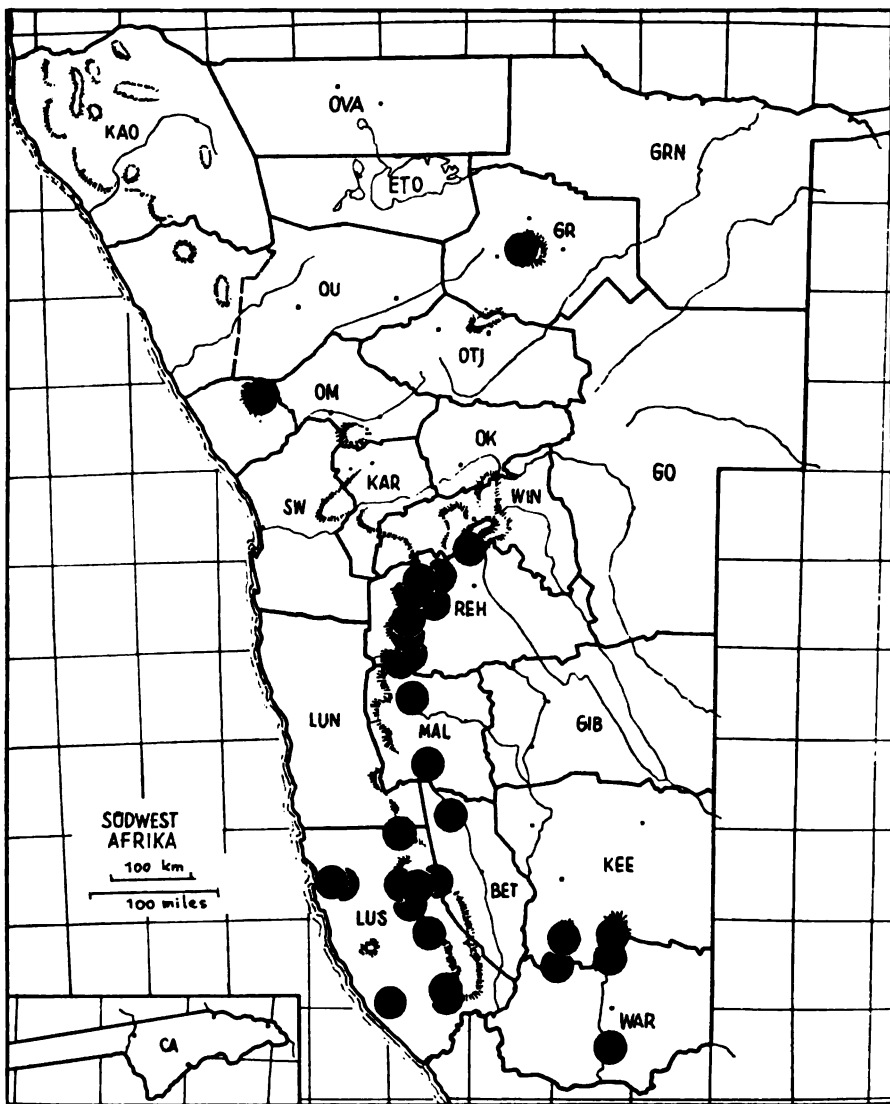


Fig. 3. Distribution in SWA of *Euryops subcarnosus*.

***E. subcarnosus***

Divaricately branching shrubs.

***E. namibensis***

Typically little-branched erect shrubs; stem  $\pm$  straight with numerous very short lateral brachyblasts.

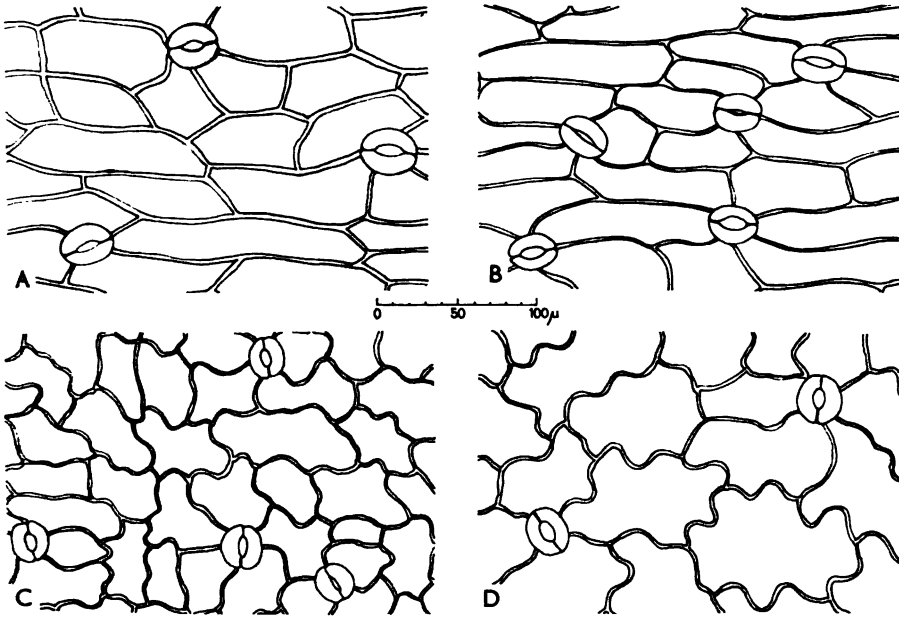


Fig. 4. Epidermis of leaf, abaxial side. — A—B: *Euryops subcarnosus*. — C—D: *E. namibensis*. — A: NORDENSTAM 1088 (LD). — B: NORDENSTAM 1197 (LD). — C: NORDENSTAM 1122 (LD). — D: NORDENSTAM 1176 (LD).

### *E. subcarnosus*

Cortex variously coloured, but often yellow or blackish, variegated or blotched, roughish or irregularly furrowed, but not distinctly sulcate.

Leaves filiform—narrowly linear, subterete—flattened, coriaceous, tripartite with the lateral lobes sometimes bifid, often some leaves entire, but never pinatifid; leaf segments 0.5–1 (–1.5) mm. wide, acute or distinctly mucronate with a white hard point.

Epidermis cells straight-walled (Fig. 4 A—B).

Capitula few—many, variously placed.

Involucral bracts 5–9.

Achenes white-villous, glossy.

### *E. namibensis*

Cortex normally evenly greyish and distinctly sulcate.

Leaves linear (—oblanceolate), flat, car-nose, mostly trifid but some entire and some pinnately partite with two pairs of lobes; leaf segments 1–3 mm. wide, obtuse—rounded, not or indistinctly apiculate.

Epidermis cells with undulating walls (Fig. 4 C—D).

Capitula numerous, concentrated to-wards the stem ends.

Involucral bracts 7–12.

Achenes white-villous, almost opaque.

**Distribution in SWA.** Lüderitz-Süd District: Buchuberg, 1929, DINTER 6447 p.p. (M); Kahanstal, 1934, DINTER 8171 (B, K); 78 miles S. of Aus on track to Witpütz, 1962, NORDENSTAM 1117 (LD); 8 miles S. of Witpütz, 1962, NORDENSTAM 1122 (LD, M); 11 miles S. of Witpütz, 1962, NORDENSTAM 1176 (LD, M); 12 miles S. of Witpütz, 1962, NORDENSTAM 1181 (LD, M); Farm Witpütz, 1963, MERXMÜLLER & GIESS 3183 (M).

Outside the area *E. namibensis* is only known from the Richtersveld, just south of the Orange River. Here it was collected already by DRÈGE in 1830 near "Verleptpram" (G-DC, P). The exact locality of this place is not known. I have found the species in several places in the Annisfontein-Hellskloof-Sendelingsdrift area (NORDENSTAM nos. 1715 a, 1719, 1725, 1740; all in LD).

Many taxa have a similar distribution, occurring only in a rather limited area around the lower Orange River. This is an exceedingly hot and arid country, and most of the species concerned are extreme xerophytes. They constitute a significant phytogeographical group, for which the term "Gariep element" is here suggested. (Gariep is the old Hottentot word for Orange River.) Some examples are: *Aloë pearsonii*, *A. pillansii*,<sup>1</sup> *A. ramosissima*, *Euphorbia chersina*, *Othonna clavifolia*, *O. opima*, *O. sparsiflora*, *Pelargonium crassicaule*, *P. klinghardtense*, *Sarcocaulon herrei*, *S. multifidum*, *Kleinia pusilla*, *Zygophyllum prismatocarpum*. Other equally characteristic representatives of the group extend somewhat more inland, into the Warmbad District and Kenhardt Division, respectively. Examples: *Aloë gariepensis*, *Diospyros acocksii*, *Pachypodium namaquanum*, *Zygophyllum leptopetalum*, many *Stapelieae* and *Euphorbias*.

Among the *Mesembryanthemaceae* many species belong to the Gariep element, e.g. *Brownanthus pubescens*, *Delosperma pergamentacea*, *Drosanthemum albens*, and *Stoeberia carpii*. Even several genera belong to the group, being wholly or almost restricted to the same small area and occurring on both sides of the river, viz. *Astridia* with no less than 16 described species, *Dracophilus* (3 spp.), *Juttadinteria* (c. 14 spp.), *Psammophora* (5 spp.), and the monotypic *Ruschianthemum*.

#### Acknowledgements

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<sup>1</sup> I believe the reports of *A. pillansii* from further north in SWA (cf. REYNOLDS 1950 p. 496) to be erroneous.

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## Beitrag zur Kenntnis einiger Arten der Gattung *Trisetum* der Türkei

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**Abstract:** Two new species of *Trisetum*, allied to *T. flavescens* (L.) Pal.-Beauv., are described from Turkey, viz. *T. turcicum* Chrtek and *T. thospiticum* Chrtek.

In der Türkei sind bisher nur zwei Arten der Gattung *Trisetum* (in engerer Auffassung, d.i. nur ausdauernde Arten) bekannt und zwar *Trisetum flavescens* (L.) Pal.-Beauv. und *Trisetum rigidum* (M.B.) Roem. et Schult. Die erstgenannte Art ist im ganzen Staate verstreut, während *T. rigidum* nur in den hochmontanen Gebieten der östlichen Staatshälfte vorkommt.

In diesem Teil der Studie will ich nur die mit der Erkenntnis der Typen um die Art *T. flavescens* verknüpfte Problematik behandeln. Unter diesem Namen werden in der Türkei sehr verschiedene Typen zusammengefasst, die schon auf den ersten Blick sehr gut zu unterscheiden sind. Als *T. flavescens* behandle ich in dieser Arbeit solche Typen, die sich vor allem unterscheiden durch verhältnismässig kleine Ährchen (4—5 mm lg.), sehr kleine Blatthäutchen ( $\pm 0,5$ —1 mm lg.) und Staubbeutel  $\pm 1,5$ —2,5 mm lg. Vereinzelt kommen Pflanzen mit grösseren Ährchen (bis 9 mm lg.) vor, z.B. Pflanzen aus Amasien (reg. subalp. mts. Abadschidagh, alt. 1300—1500 m s. m., VII.1889, leg. BORNMÜLLER, B, JE). Dieser grossährchige Typ ähnelt etwas der Art *T. turcicum*. Er unterscheidet sich jedoch von dieser durch behaarte Deckspelzen der oberen Ährchenblüten. Solche behaarte Deckspelzen der oberen Ährchenblüten finden wir jedoch auch bei einigen kleinährchigen Typen. Eine taxonomische Wertung dieses Merkmales erfordert jedoch ein weiteres Studium.

Von *T. flavescens* unterscheiden sich, im erwähnten Sinne, deutlich

Pflanzen der montanen östlichen Staatshälfte. Sie kennzeichnen sich vor allem durch grosse Ährchen, lange Staubbeutel, mächtigen Wuchs und meistens durch lange  $\pm$  zusammengezogene Ährchenrispen mit goldbraun gefärbten Ährchen. In Hinblick auf die angeführten Merkmale erachte ich diesen Typ als eine selbständige Art und bezeichne sie mit dem Namen *Trisetum turcicum* spec. nova.

***Trisetum turcicum* species nova**

Planta perennis, sparse caespitosa, cum stolonibus brevibus, culmi (30)45—80(90) cm alti, suprema culmorum folia (4)6—12(14) cm lg. et (1,3)2—3,5 (4,5) mm lata, folia in parte adaxiali pilosa usque subglabra, in parte abaxiali saepissime glabra, vaginae foliorum culmorum pilosae usque glabrae, ligula (1,0)1,5—2,0(3,0) mm lg., saepe in parte abaxiali breviter pilosa, panicula (6)8—12(14) cm lg. et (1,5)2—3(3,5) cm lata, aliquantum usque valde contracta, spiculae saepissime 3florae, (6)8—10(13) mm lg., saepissime aureo-fuscae, glumae inaequaliter longae, inferiores 3,5—5,5 mm lg., superiores 5,5—8,5 mm lg., lemmata florum inferiorum 5—8 mm lg., setae eorum 7—12 mm lg., in inferiore parte dimidia contortae, geniculate inflexae, denticuli setae brevis, paleae 5—7(8) mm lg., carinae paleae breves aculeolatae, pili rhachilae  $\pm$  1,5—2,0 mm lg., antherae (3)3,5—4,5(5,2) mm lg.

T y p u s: B. BALANSA, in valle Djimil (Lazistan), ca 2000 m, VIII.1866 (sub 1551 *Trisetum flavescens* Trin. var.). Typus in herbario botanicae cathedrae rerum naturalium facultatis Universitatis Carolinae Pragaе conservatur (PRC).

A r e a g e o g r a p h i c a: pars orientalis Turciae et Caucasus.

Von der Art *T. flavescens* unterscheidet sich diese Art hauptsächlich durch grössere, längere Staubbeutel, eine grössere und meistens  $\pm$  zusammengezogene Ährchenrispe und einen mächtigeren Wuchs. Die Blatthäutchen sind auch länger als bei *T. flavescens*. Im ganzen macht *T. turcicum* auf den ersten Blick einen mächtigeren Eindruck als *T. flavescens*.

Von der Art *T. sibiricum* Rupr. unterscheidet sich die neue Art vor allem durch den Bau der Deckspelzengranne. Die Granne der Art *T. turcicum* ist im unteren Teil einigemale gedreht und im mittleren Teil knieförmig gekrümmt. Bei *T. sibiricum* sind die Grannen nur  $\pm$  bogenförmig gebogen, jedoch nicht knieförmig gekrümmt und in der unteren Hälfte nur sehr schwach gedreht. Die Ährchenrispe des *T. turcicum* ist  $\pm$  zusammengezogen, bei *T. sibiricum* subsp. *sibiricum* jedoch  $\pm$  ausgebreitet. Auch die Blätter des *T. sibiricum* sind durchschnittlich breiter als bei *T. turcicum*.

Die Art *T. sibiricum* gehört zu den am meisten veränderlichen Arten der Gattung *Trisetum*. Die Variabilität erscheint hauptsächlich im Wuchs, dem Charakter der Ährchenrispe, der Ährchengrösse, der Breite

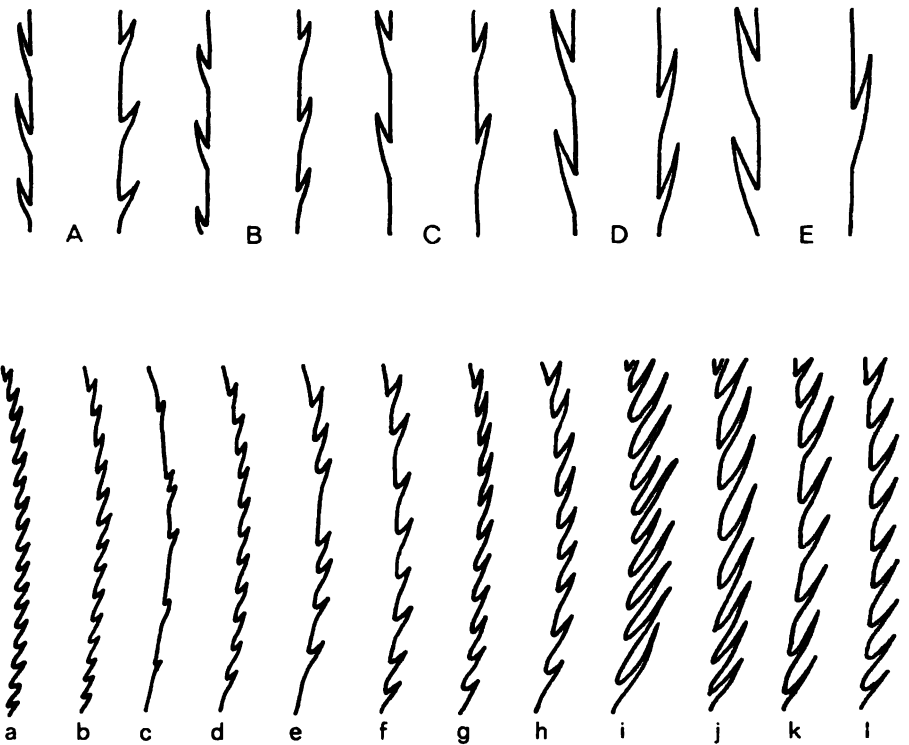


Fig. 1. A—E. Schema der Grannenbehaarung. A. *Trisetum flavescens*. B—C. *T. turcicum*. D—E. *T. thospiticum*. — a—l. Schema der Behaarung der Vorspelzenkiele. a—c. *Trisetum flavescens*. d—h. *T. turcicum*. i—l. *T. thospiticum*.

der Blätter, der Ährchenfärbung u.a.m. Im arktischen Gebiet ist *T. sibiricum* subsp. *litorale* (Rupr.) Roshev. verbreitet und durch einen verhältnismässig kleinen Wuchs, zusammengezogene Ährchenrispe und verhältnismässig kurze Grannen gekennzeichnet. Sehr beachtenswerte Typen kommen in der Mongolei und China vor, wo man Typen sowohl mit auffallend zusammengezogenen Ährchenrispen, als auch mit kleinen und grösseren Ährchen, mit breiten und schmalen Blättern findet. Keine dieser Typen ist jedoch mit *T. turcicum* identisch.

Das *T. turcicum* aus dem Kaukasus wurde wahrscheinlich als *T. sibiricum* betrachtet und zwar insbesondere auf Grund der Ährchengrösse. Ob das echte *T. sibiricum* im Kaukasus wächst, ist mir nicht bekannt; ich habe aus dem Kaukasus bisher nicht einen einzigen Beleg gesehen.

Die Art *T. turcicum* wächst in den Gebirgen der östlichen Staats-

hälfte der Türkei und im benachbarten Kaukasus. Aus Iran kenne ich diese Art bisher nicht.

Beachtenswert sind die aus südlicheren Gegenden der Türkei stammenden Pflanzen (z.B. *Taurus Cataonicus*). Bei diesen Pflanzen sind die Ährchenrispen oft auffallend dicht und manchmal auch kürzer als die der Pflanzen aus den nördlichen Arealteilen. Es scheint, dass es sich um irgendeinen selbständigen Typ innerhalb der Art *T. turcicum* handelt; es wäre notwendig diesen direkt im Terrain zu verfolgen.

**Eingeschene Herbarbelege.** T ü r k e i: Vallée de Djimil (Lazistan), vers 2000 m — prairies, VIII.1866, B. BALANSA, Plantes d'Orient, BP, JE, P, PRC, W; Sipikordagh, 5.VII.1889, P. SENTENIS, Iter orientale, JE; Région sous-alpine du Mont-Argée (Cappadoce), vers 2.100 m, 9.VII.1856, B. BALANSA, Pl. d'Orient, MANCH; In gramin. m. Beryt dagh, Cataoniae, 7—8000', 9.VIII.1865, HAUSSKNECHT, Iter Syriaco-Armeniacum, JE, W; Taurus Cataonicus, in monte Ak Dag, inter urbem Malatja et vicum Kjachta, in lapidosis, ca 2300 m, 17.VII.1910 HANDEL-MAZZETTI, W; Taurus Cataonicus, inter urbem Malatja et vicum Kjachta, in declivibus opimis montis Gök Tepe versus Kumik, ca 2000 m, 16.VII.1910, HANDEL-MAZZETTI, W.

K a u k a s u s: Ossetija, Vladikavkazskij okrug, Tereskaja obl., Adaj-Choch, in pratis alpinis, 9000', 29.VII. 1900, MARKOVIČ, JE; Transcaucasia, inter p. Aravsja et m. Arazhin in subalpinis, 29.VII.1933, GADZIEV, GURVITSCH, ULUBABOV, BAK; Transcaucasia, Azerbajdzhan, distr. Konachkend, 5 km ad austro-occ. p. Talysch, 8.VIII.1937, ROZHKOV, BAK; Transcaucasia, Azerbajdzhan, distr. Konachkend, 6—8 km ad boreo-occ. p. Derk, 4.VIII.1937, ROZHKOV, BAK.

Einen weiteren wichtigeren und charakteristischen Typ aus der Türkei fand ich im Herbar des Königlichen botanischen Gardens in Edinburgh (E). Diese Pflanze wurde in der Umgebung des Sees Van gesammelt und wurde von Prof. BOR revidiert, der sie als *Trisetum* sp. bezeichnete. Diese Pflanze unterscheidet sich auf den ersten Blick von der verwandten Art *T. flavescens* vor allem durch den Charakter der Ährchenrispe; diese ist zusammengezogen und  $\pm$  dicht. Weiter unterscheidet sie sich durch einige weitere Merkmale wie z.B. durch Behaarung der Vorspelzenkiele und der Grannen. Die Zähnchen der Vorspelzenkiele und Grannen sind durchschnittlich länger als bei der Art *T. flavescens* und *T. turcicum*; von *T. turcicum* unterscheidet sie sich vor allem durch einen niedrigeren Wuchs, kleinere Ährchen, kürzere Staubbeutel und insbesondere durch den Gesamthabitus.

***Trisetum thospiticum* species nova**

Planta perennis, dense caespitosa, culmi  $\pm$  35 cm alti, folia innovatorum 2,5—3 mm lata (superior pars foliorum deleta), folia in parte abaxiali et



adaxiali breviter pilosa vel subglabra, vaginae foliorum breviter pilosae, emortuorum foliorum dilaceratae, ligula brevis  $\pm 0,5$  mm lg., vaginae foliorum culmorum breviter disperse pilosae vel subglabrae, ligula  $0,5-0,8$  mm lg., lamina foliorum deletae, panicula  $\pm 5,5$  cm lg. et  $1,5-2$  cm lata, contracta, densa, spiculae saepissime biflorae,  $7-8$  mm lg., glumae inaequaliter longae, inferiores  $3,5-4,5$  mm lg., superiores  $5,5-6,5$  mm lg., lemmata florum inferiorum  $6-6,7$  mm lg., setae eorum  $6-9$  mm lg., denticuli setae infirme prolongati, longi ut  $1/2$  usque tota setae latitudo, paleae  $5,2-6,5$  mm lg., carinae paleae infirme aculeolatae, pili rhachillae,  $\pm 1,5$  mm lg., antherae  $2,2-3,0$  mm lg.

Typus: Prov. Bitlis: Suphan Dag, 3300 m, 28.IX.1954, DAVIS 24,763 a. POLUNIN. Typus in herbario Regii bot. horti Edinburgensi conservatur (E).

Area geographica: Suphan Dag prope lacum Van.

Etymologia: nomen est secundum vetus nomen lacus Van (lacus Thospitis).

### Zusammenfassung

In der vorliegenden Arbeit werden aus dem Bereiche der Art *T. flavescens* zwei neue Arten aus der Türkei und zwar *T. turcicum* und *T. thospiticum* beschrieben. Es werden Unterscheidungsmerkmale gegenüber verwandten Arten und ihre kurze Charakteristik angegeben.

## Studies on a Method for Measuring Fluxes of $\text{Na}^+$ over the Cytoplasmic Boundary of *Scenedesmus*

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Studies by classical analytical means allow only measurement of the net movements of ions in or out of cells and tissues. The introduction of the isotope technique put an end to this limitation and made it possible to discern influx and outflux as parts of the over-all transport. However, due to the effects of isotopic dilution, problems are involved in the transformation of data obtained by isotopes into absolute fluxes. By suitable arrangement of the conditions of the experiment, it is sometimes possible to avoid these complications (see, e.g., DIAMOND & SOLOMON 1959 or GAFFEY & MULLINS 1958), but on other occasions appropriate equations must be worked out in order to evaluate the primary data.

As far as plants are concerned, the first formulations for solving the problem have been made by BRIGGS (1957). They have been used in the study of storage tissue by VAN STEVENINCK (1964), and they were further developed by PITMAN (1963) to allow for the compartmentalization within the cells of beetroots. Parallel equations were given by MACROBBIE & DAINY (1958 a) for *Rhodymenia palmata*, and they have later been used and extended further in experiments with characeans (MACROBBIE & DAINY 1958 b, MACROBBIE 1962, 1964).

The above-mentioned approaches are all based on the parallel application of isotopic and conventional analyses. The fluxes recorded concern mainly  $\text{K}^+$ ,  $\text{Na}^+$ ,  $\text{Cl}^-$ , and  $\text{Br}^-$ . Difficulties involved in the use of  $\text{Na}^+$  have been reported by MACROBBIE (1962) and by PITMAN (1963).

Sodium ions are excluded from cells of *Scenedesmus*, deficient in P (KYLIN 1964 b). However,  $\text{Na}^+$  is taken up if adequate amounts of phos-

phate are again added to the medium. It was realized that this system offers possibilities for measuring and evaluating the absolute fluxes in short-time experiments by means of a double application of isotope of a type used earlier in long-time runs with sulphur (KYLIN 1964 a). Such an approach is also advantageous in that it eliminates the necessity of using radioactive solutions for flame photometry, which otherwise may have to be used as the conventional method for the determination.

In order to evaluate these possibilities, preliminary experiments were made in connection with work to characterize the mechanism for extrusion of  $\text{Na}^+$  (KYLIN 1966). For the sake of clarity, the flux determinations will be treated separately here.

The methods for cultivating our strain of *Scenedesmus* sp. to an advanced degree of P-deficiency have been described earlier (KYLIN 1964 a, b). The cells were harvested and allowed to take up  $^{22}\text{Na}$  from 1 or 2 mM-NaCl in a complete nutrient solution containing a 5 mM buffer of K-phosphates at pH 6.5. After 2 hours they were properly washed and transferred to solutions with (A) non-radioactive or (B) radioactive 1 mM-NaCl. These solutions were kept at pH 6.5 with 27.5 mM-citric acid/KOH, and contained either 5 mM K-phosphates or an equivalent amount of  $\text{K}^+$  as the chloride. Otherwise the solutions were of the same composition as during the pretreatment. The experiments were made at 25°C, in darkness or at the light intensity of the pretreatment (approximately 15000 ergs/cm<sup>2</sup> and second). Samples were taken at regular time intervals, and the cells analyzed for  $^{22}\text{Na}$ .

For a given time interval, the mean specific activity for the cells in inactive solutions is given by their mean content of  $^{22}\text{Na}$  (determined directly), divided by their mean content of total sodium. The latter figure is represented by the data from the treatments with  $^{22}\text{Na}$ , since there is no measurable content of  $\text{Na}^+$  in the original, P-deficient cells. Efflux of  $^{22}\text{Na}$  is determinable as the difference between two consecutive samples from the inactive medium, and the value thus found divided by the mean specific activity will approximately give the efflux of total Na, as long as the effects of compartmentalization within the cells are negligible. From this total efflux and from the net movement of sodium in or out from the cells (found from the parallels in radioactive solutions), the real influx of  $\text{Na}^+$  can, finally, be computed. — If Na is substituted for S, equations (5) and (7) in KYLIN (1964 a) can be used to describe the computations. The approximation (5) is valid since the specific activity of the "inactive" solution (which is due to the losses from the radioactive cells) will in the present conditions never exceed 1 per cent of what is found in the radioactive solutions.

In connection with the main investigation, an example of a set of primary data is given (KYLIN 1966). In table 1 all the values of effluxes and influxes computed from this set are found. It can be seen

**Table 1. Rates of Efflux and Influx of Total  $\text{Na}^+$** 

Values in  $\mu\text{eq/g}$  dry weight and hour, computed for the time intervals indicated. Data from KYLIN (1966), table III.  $\text{Na}^+$ , 1 meq/l during both pretreatment and experiment. Light.

Direction of flux	Initial phosphate	0	30	Minutes from start	180	240
				60	120	
Efflux	0 mM	9.6	3.3	—	1.3	—
	5 mM	18.0	12.3	6.3	6.1	6.6
Influx	0 mM	1.6	2.3	—	0.4	—
	5 mM	22.6	20.7	10.6	8.8	5.3

that the fluxes computed decrease with time. This means that compartmentalization occurs within the cells, but plots of the variations with time of the logarithm of the  $^{22}\text{Na}$  remaining in the cells in the different washing-out experiments (cf. MACROBBIE & DAINITY 1958 a, b) do not provide a simple answer as to the number of compartments concerned. In series in light, in the presence of external phosphate, there is one slower compartment with a half-life for the loss of  $^{22}\text{Na}$  of about 210 minutes, and a faster compartment with a half-life of the order of 20 minutes. Darkness as well as the absence of external phosphate alter the rates of exchange within both these compartments — thus indicating that they are found within the boundaries of the protoplasm — but in addition data from such treatment may indicate that there is still another compartment within the plasmalemma.

The work of MACROBBIE (1962) and of MACROBBIE & DAINITY (1958 b) identified the vacuoles and the protoplasmic non-free space as compartments inside the plasmalemma of species of *Nitella*, and similar results were reported for beetroot tissue by PITMAN (1963). However, from the results of SALTMAN et al. (1963) with *Nitella*, one can imagine that also the chloroplasts may act as a separate compartment for  $\text{Na}^+$ . This special problem will be left until more detailed data are available.

The half-life for the fastest compartment as reported above is only about one fifth of the figures given by MACROBBIE & DAINITY (1958 b) for the protoplasmic non-free space of *Nitella* or by PITMAN (1963) for the cytoplasmic phase in beetroots, a difference which is probably due to differences in cellular dimensions. From the point of view of the flux measurements, this means in any case that only the first intervals during the introductory experiments presented here give reasonable approximations of the total fluxes of  $\text{Na}^+$  across the plasmalemma (cf. GAFFEY & MULLINS 1958). In table 2 examples are given of such values obtained under different conditions.

Table 2. Rates of Efflux and Influx of Na<sup>+</sup> in *Scenedesmus*

Fluxes computed in  $\mu\text{eq/g}$  dry weight and hour from figures for the time interval 0—30 minutes.

Na <sup>+</sup> in medium, meq/l		Light	Efflux		Influx	
Pretreatment	Experiment		0 mM-P	5 mM-P	0 mM-P	5 mM-P
1	1	+	9.6	18.0	1.6	22.6
1	1	—	14.8	20.2	4.2	16.2
2	1	+	35	82	2.5	33
2	1	—	38	50	0	14

The enhancing effect of external phosphate on both efflux and influx of Na<sup>+</sup> is confirmed for all conditions used (cf. KYLIN 1966). The effects of light are not clear. A change from 2 to 1 mM-NaCl in the medium at the start of the experiment proper will raise the efflux considerably as compared with cells with 1 mM-NaCl in the solution during both pretreatments and measurements.

Using the general cell data presented earlier (KYLIN 1964 a), one can recalculate the fluxes of Na<sup>+</sup> over the cytoplasmic boundary reported here and compare their order of magnitude with those given in the literature for some other materials. For the combination (1 to 1 mM-NaCl/external phosphate), where the cells are near equilibrium, the fresh-water organism *Scenedesmus* at 25°C shows higher fluxes than beetroot tissue at 2°C (PITMAN 1963), but lower than the sea-weed *Rhodymenia palmata* at 8°C (MACROBBIE & DAINITY 1958 a). The cells of fresh-water *Chara* used by GAFFEY & MULLINS (1958) were evidently losing Na<sup>+</sup>, but the influx rates were of the magnitude reported here. In the fresh-water *Nitella translucens* at 20°C (MACROBBIE 1962), the movements of Na<sup>+</sup> across the plasmalemma are comparable to the present ones, but in the brackish-water *Nitellopsis obtusa*, also at 20°C, they are at least 10—20 times higher (MACROBBIE & DAINITY 1958 b).

Summarizing, the exploratory experiments show that it is possible to use the method envisaged to measure the different fluxes of sodium across the plasmalemma of *Scenedesmus*. The values obtained fall within the amplitude given by other investigations. The main difficulty is connected with the compartmentalization of the cells, where the non-free fraction with the fastest exchange shows a considerably shorter half-life than reported from other materials. The fluxes across the plasmalemma and the compartments within the protoplast are affected by the presence or absence of phosphate in the medium.

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## Cytotaxonomical Note on *Lilaea*

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**Abstract:** The chromosome number of *Lilaea subulata* H. et Bpl. is reported for the first time. The diploid number is  $2n=12$ . A discussion of the systematic position of *Lilaea* leads to the conclusion that it should be included in the *Juncaginaceae*.

The subdivision into families of the *Helobiales* (*Alismatales*) has been a matter of discussion for a long time, and probably no two of the larger textbooks of Angiosperm taxonomy agree on the same system. HUTCHINSON (1959) thus has a rather narrow family concept while ENGLER's Syllabus (1964) is more conservative.

The interesting monotypic genus *Lilaea*, widely distributed in North and South America, is referred by HUTCHINSON to a separate family distinct from *Juncaginaceae*, while more authors draw attention to the similarity of *Liliaea*, *Triglochin*, *Maundia*, and *Tetroncium* in several respects, viz. in floral morphology (the enlarged bract-like connective), pollen morphology and embryology. In many respects *Lilaea* must be regarded as the most advanced.

The four genera mentioned above have, however, not yet been able to inspire cytologists to a closer study even if this should seem to be the most obvious course. Only the genus *Triglochin* has previously been studied.

In order to count the chromosome number, material of *Lilaea subulata* H. et Bpl. has been fixed in the Botanic Garden, Copenhagen, where the species has been grown for some years and flowers abundantly. Material of the specimen fixed has been preserved in alcohol and deposited in the herbarium of the Botanical Institute, Aarhus (Herb. AAU). Unfortunately it has not been possible to trace the origin of the plant.

The root tips were fixed in Navashin-Karpetchenko's fluid and after-



Fig. 1. Metaphase plate from root tip of *Lilaea subulata* showing  $2n=12$ . — The scale is 10  $\mu$ .

wards treated according to the paraffin method and finally stained with Feulgen.

Several good metaphase plates were observed and the chromosome number found to be  $2n=12$  (Fig. 1). The chromosomes are rather small having the same general morphology as the species studied of *Triglochin*. The basic number for this genus is given as  $x=6$  and 8 by DARLINGTON & WYLIE (1955), while LÖVE & LÖVE (1961) give  $x=6$  only. Our present knowledge of the *Juncaginaceae* may be summarized as follows:

- Triglochin maritimum* L.:  $2n=12, 24, 30, 36, 48, 60, 120$
- *palustre* L.:  $2n=24$
- *bulbosum* L.:  $2n=30, 32$
- *gaspense* Lieth & Löve:  $2n=96$
- *concinna* Burtt Davy:  $2n=24$
- *laxiflorum* Guss:  $2n=18$

After this it is clear that the deviations from the 6-series are oscillations which are found in many groups. It does not therefore seem justifiable to speak of more than one basic number, viz.  $x=6$ .

The conclusion, therefore, is that both basic number and chromosome morphology of *Lilaea* and *Triglochin* are in close correspondance. There is thus also cytological support for uniting *Lilaea* with the *Juncaginaceae*.

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## Svensk Botanisk Litteratur 1965

### Swedish Botanical Bibliography 1965

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#### Starkare förkortningar — Shorter abbreviations

ACS: Acta Chemica Scandinavica, Köbenhavn (tr. i Helsinki).

BG: Botanica Gothoburgensia, Göteborg.

BN: Botaniska Notiser, Lund.

ECR: Experimental Cell Research, New York (tr. i Uppsala).

GP: Grana Palynologica, Stockholm.

Her.: Hereditas, Lund.

MIF: Microbial Inhibitors in Food, 4. Intern. Symp. Food Microbiol. Göteborg. Sweden, 1964, ed. N. Molin, Almqvist & Wiksell, Stockholm (tr. i Uppsala).

PCS: The Plant Cover of Sweden. A study dedicated to G. Einar Du Rietz on his 70th birthday April 25th 1965 by his pupils. Acta Phytogeogr. Suec. 50. Uppsala.

PP: Physiologia Plantarum, Köbenhavn (tr. i Lund).

SBT: Svensk Botanisk Tidskrift, Stockholm.

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## Litteratur

ZIMMERMANN, WALTER: Die Telomtheorie. — Gustav Fischer Verlag. Leipzig 1965. 236 pp. Pris DM 48.

Alltsedan ZIMMERMANN i första uppl. av »Die Phylogenie der Pflanzen» år 1930 publicerade telomteorin, har denna teori haft en stor, för att inte säga avgörande betydelse för tolkningen av de högre växternas morfologi och därmed deras fylogeni. Den här under de gångna åren kraftigt stimulerat forskningen inom dessa vetenskapsgrenar. Talrika är de undersökningar, som genomförts med stöd av denna teori eller för kontroll av dess bärkraft. I många fall har de lett till högst intresseväckande, ej sällan överraskande resultat.

När därför ZIMMERMANN nu sammanfattar telomteorin och bl.a. testar den med *Ranunculaceae* som »modellfamilj», tar man med spänning del av hans framställning. Han utgår som bekant från de dikotoma (gaffelformiga) förgreningstyper, som möter hos de »första landväxterna», *Rhynia* och närstående grupper, från översilur och devon. Från de ursprungliga, schematiska telomställningarna härleder han genom 5 grundprocesser — Öbergipfelung (»övertoppning»), reduktion, planation, sammanväxning och inkurvation — alla de skiftande förgreningstyper och organkonstellationer, som möter hos de högre växterna såväl i deras vegetativa som reproduktiva regioner. Stammar, blad och blomdelar tolkas som derivat av gaffelgreniga telomställningar. Ytterst är således enligt telomteorin dessa organ eller organkomplex homologa.

De högre växternas ståndare har bäst bevarat sin karaktär som telomställningar, medan däremot den honliga reproduktionsapparaten är mera svårtolkad och därför till sin natur omstridd. Här finns i överensstämmelse därmed ett stort antal skilda teorier. Särskilt uppmärksammas är LAM's uppfattning, att de högre växterna bör indelas i två huvudgrupper: stachyospora (stachyosperma) och fyllospora (fyllosperma) växter, vilkas »skilsmässa» skulle gå tillbaka ända till psilofyterna. ZIMMERMANN ansluter sig till fyllosporteorin men påpekar, att för telomteorins grunduppfattning denna fråga ej är synnerligen viktig, eftersom båda slagen av placensation under alla förhållanden låter sig härledas ur telomställningar.

ZIMMERMANN'S framställning av telomteorin är synnerligen koncentrerad. Han har lyckats klargöra teorins principer och dess följdverkningar beträffande de högre landväxternas morfologi, system och fylogeni på föga mer än 200 trycksidor, av vilka en stor del upptages av illustrationer. De senare är f.ö. synnerligen väl valda och presenteras av förlaget på ett högst tilltalande sätt.

HENNING WEIMARCK

Öresundskust. — Skrifter utgivna av Föreningen Landskronatraktens Natur V. Värnamo 1966. 206 sid. + 16 pl. Pris 20 kr.

Föreningen Landskronatraktens Natur bildades på GUNNAR WEIBULLS initiativ år 1953. Föreningen har nu med boken »Öresundskust» rest ett äreminne över sin grundare, som så tragiskt gick bort vid flygkatastrofen vid Ängelholm 1964.

Boken inleds med en minnesruna, skriven av ELSA LINDHOLM, som ger en bild av den strängt upptagne företagschefen och den samtidigt lugne, lycklige familjefadern. GUNNAR WEIBULL hann märkvärdigt mycket inom familjeföretaget, i riksdag och landsting och i ideella sammanhang och hade ändå tid att i utpräglad grad vara människa. Så följer GABRIEL JÖNSSONS högstämda hymn till Öresund, denna »nationernas gata», där ännu in på 1950-talet fullriggare under segel kunde förevisas, minnande om svunna tiders syner. »Glädjen över Öresund består naturligtvis innerst däri att man helt enkelt är förälskad i detta stycke landskap, detta stråk - - -».

Så följer fyra uppsatser om naturvårdslagar, förordningar och planeringsfrågor. Här redogör BÖRJE LUNDGREN, enmansutredaren av natur- och landskapsvårdens organisationsproblem, för den nya naturvårdslagen, EBBE BORG för »Naturvård och regionplanering vid Öresund», GÖSTA NETZÉN för »Den försummade naturvården», där han behandlar vattenföreningen i Sundet, och HARALD DE SHÄRENGRAD för »Hven. Natur, bebyggelse, framtid».

GUNNAR JOHNSON har en artikel om »Glumslövs backar», där han beskriver backarnas inre struktur och hur de bildats, BÖRJE LÖVKVIST om »Några intressanta strandväxter vid Öresundskusten», där han behandlar ekotyper av *Hieracium umbellatum*, *Centaurea jacea* och *Galium verum* samt problem inom *Lepidium latifolium* och *Artemisia maritima*, MÅRTEN SJÖBECK om Ylles hed, som en gång sträckte sig från trakten av Billeberga till Sireköpinge och kan betraktas som en resthed av ett forna större hedkomplex, samt slutligen ARVID NILSSON om växter och djur på Landskronatraktens ättehögar.

»Öresundskust» är en utsökt bok med sin fina omslagsteckning, *Dactylis* av GUNNAR NORRMAN, sin vackra typografi och sina väl valda bilder.

HENNING WEIMARCK

ELSA NYHOLM: *Illustrated Moss Flora of Fennoscandia*, II:4 och 5. — C.W.K. Gleerup. Lund 1960 resp. 1965. Pris 15: 50 resp. 33 kr.

Med de två här anmälda häftena har förf. nästan avslutat de egentliga bladmossorna (underkl. *Bryales*) i sin välkända mossflora. Häfte 4 är redan 6 år gammalt men har tidigare ej anmälts i Botaniska Notiser. Häfte 5 bär tryckåret 1965 men blev ej tillgängligt förrän 1966. Av bladmossor återstår nu *Andreaeales* och *Sphagnales* samt fam. *Polytrichaceae* av *Bryales*.

Häfte 4 omfattar främst orthotrichaceerna och början av ordningen *Hypnobryales*, dessutom fam. *Bartramiaceae* och några närstående småfamiljer. Största intresset tilldrar sig orthotrichaceerna (hättemossorna) såsom ofta svårbestämda. Här lämnar bladkaraktärerna föga hjälp i oillustrerade florer annat än för att skilja släktena åt. Alla arter i släktet *Orthotrichum* har påfallande lika blad, och man är mest hänvisad till skillnader i sporogonens plats och utseende. Där bladskillnader dock finns är de i denna flora tillvara-

tagna i figurerna (jag tänker härvid särskilt på *O. speciosum* med rätt »långspetsade» blad). Kapslarnas utseende i torr och fuktig väderlek framgår också tydligt. Peristomtändernas finstruktur har förf. gjort sig mycken möda att framställa, och klyvöppningarnas utseende åskådliggörs utmärkt hos alla arter, där saken har betydelse för artbestämningen. Liksom hos andra kritiska släkten (jag avser närmast *Bryum*) har förf. städat upp bland mängden beskrivna arter och helt strukit ett par, reducerat några till underarter och samlat några som »tvivelaktiga» i en särskild grupp.

Som i föregående delar förekommer en del systematiska omplaceringar eller andra nyheter. Släktet *Zygodon* tillerkänns tre klara arter i Sverige, varav den vanligaste nu heter *Z. vulgaris* (Malta).

I den stora ordningen *Hypnobryales* har fem tidigare som nordiska upptagna *Fontinalis*-arter strukits, och i fam. *Leskeaceae* har t.ex. *Heterocladium papillosum* förts till släktet *Pseudoleskeella* (modell S. O. LINDBERG). Samma släktnamn har också drabbat den i kontinentala områden ej sällsynta *Leskeella nervosa*.

Figureerna kan allmänt sägas ha blivit bättre och bättre för varje häfte. Tills vidare skall här endast framhållas några *Thuidium*-arter, som förf. ritat stora och utmärkta habitusbilder av. De jämbreda skotten hos *Th. recognitum* må jämföras med de trekantiga hos *Th. tamariscinum*! De övriga arterna i släktet är intermediära och skiljs bäst på mikroskopiska karaktärer, tydligt framhållna i bladteckningar. De härlika bladspetsarna på stambladen hos *Th. philiberti* hade t.o.m. kunnat få göras ännu längre!

Häfte 5 har svällt ut till dubbla tjockleken jämfört med tidigare häften och omfattar de fyra storfamiljerna *Amblystegiaceae*, *Brachytheciaceae*, *Hypnaceae* och *Plagiotheciaceae* jämte tre småfamiljer. Endast den som i åratals brottats med bestämningar av *Drepanocladus*-, *Amblystegium*- och *Plagiothecium*-arter har — förmodligen! — chans att förstå det jättearbete av hand och hjärna, som ligger bakom detta häfte. Det är en revision av artuppfattningar och släktbegränsningar, nomenklatur och morfologiska jämte finanatomiska detaljer, som måste ha varit oerhört tidsödande. Såvitt jag har möjlighet att bedöma har förf. också goda skäl för de flesta av sina åsikter. Rent nomenklatoriska frågor tar jag ej ställning till, men några smärre divergenser i mitt eget sätt att se skall dras fram senare.

Släktet *Drepanocladus* är bland mossforskare välkänt som ett av de mera kritiska. Av nyheter märks här *D. schulzei* Roth, som tidigare förbisetts men av förf. förmodas vara »common». Den är något av ett mellanting mellan *D. fluitans* och *D. exannulatus*.

Två arter, dels den nordliga *D. tundrae*, dels *D. pseudostramineus* (tidigare mest tolkad som varietet eller forma) bildar på grund av sina rätt kortspetsade blad sektionen *Calliergidium* och syns bilda övergång till släktet *Calliergon*. En art, *D. lapponicus*, har förf. i likhet med Z. SMIRNER upphöjt från varietet av *D. vernicosus*, och en, *D. polycarpus*, är »avstyckad» ur *D. aduncus*' formkrets.

Släktet *Calliergon* har undergått mycket obetydliga förändringar, något som kan anses framhäva detta Kindbergska släktes naturliga begränsning. Samma kan sägas om släktet *Hygrohypnum*. Förändringarna inom fam. *Amblyste-*

*giaceae* är annars — betecknande nog — flera än inom fam. *Brachytheciaceae*: vattenväxter är starkare variabla än landväxter. Med förändringar menas här sådana omplaceringar i systemet som kan föras tillbaka på varierande uppfattning av en arts systematiska värde, däremot ej namnförändringar, föranledda av (andra) nomenklatoriska spetsfundigheter.

Man kan också fråga sig, vilka olikheter som ska tillmätas största värdet vid avgörandet av en arts (eller annan enhets) systematiska ställning, de makro- eller mikroskopiskt morfologiska eller andra, t.ex. fysiologiska eller sociologiska. Jag tänker härvid på t.ex. *Campylium stellatum* var. *protensum* (s. 480) resp. *Eurhynchium praelongum* var. *distans* (s. 520). Båda dessa här som varieteter upptagna taxa har jag själv sedan länge uppfattat som arter, huvudsakligen av sociologiska skäl: de tillhör andra växtsamhällen än de som av förf. här uppfattats som deras resp. huvudarter. Hur pass konstanta de egenskaper sedan är, som åstadkommer denna fördelning på olika sociologiska enheter, är ännu en olöst fråga. Faktum är att de existerar.

En annan art, *Rhytidiadelphus calvescens* (Wils.) (s. 614), tillhör samma växtsamhälle (i östra Mellansverige åtminstone) som *Campylium protensum* och har också av förf. räknats som art. Det är enligt min uppfattning ej svårare att till habitus skilja *Campylium protensum* från *C. stellatum* än *Rhytidiadelphus calvescens* från *R. squarrosus*.

I släktet *Rhytidiadelphus* har förf. även placerat *Hylocomium brevirostre* på grunder som syns mig skäligen tveksamma, särskilt som släktet *Rhytidiadelphus* en gång av WARNSTORF uppställdes för hylocomiaceér utan parafyllier. Annars skall det erkännas, att *H. brevirostre* verkligen till habitus mer liknar *Rhyt. calvescens* (eller varför inte *Eurhynchium striatum*) än en *Hylocomium*. Den har dock tydliga parafyllier.

Medan vi är inne på hithörande arter, måste bilderna över de grövre skogsmossorna få ett särskilt erkännande. Särskilt väl framträder skillnaden i arkitektonik mellan *Hylocomium splendens* och *H. umbratum*. En hel bildsida och mer än en textsida är ägnade åt *Hypnum cupressiforme* och några av dess former. Tre förr oftast som underarter betraktade sådana har förf. gett artvärde.

Samma har skett rätt frikostigt i släktet *Plagiothecium*, där utom de »fasta» arterna *P. denticulatum*, *latebricola*, *piliferum* och *undulatum* upptagits följande sex: *P. curvifolium*, *laetum*, *platyphyllum*, *roeseanum*, *silvaticum* och *succulentum*. Samtliga är m.l.m. besläktade med *P. denticulatum*, många är kritiska och svårbestämda, en del övergår direkt i varandra etc., vilket också framgår av olika floraförfattares starkt divergerande uppfattningar om dem. Under sådana förhållanden torde det vara riktigtast att behålla dem som arter i väntan på de odlingsförsök förf. själv så ofta efterlyser.<sup>1</sup> Dock skulle jag önskat samma upphøjelse för *P. denticulatum* var. *undulatum* (s. 641), som tidigare ofta behandlats som art under namn av *P. ruthei*. Personligen tycker jag detta går bra — av både morfologiska och sociologiska skäl! I varje fall är det tråkigt, om nomenklatoriska skäl ger företräde åt namnet *undulatum*, eftersom redan en god art med detta namn finns i släktet.

I bildmaterialet har på många ställen i del 5 införts några mycket små

<sup>1</sup> Jfr SONESSON i Bot. Notiser 1966 s. 379!

blad, betecknade med två små vertikala streck. Teckenförklaring saknas!

För del 6, som enligt förljudande ligger i långt framskridet manuskript, skulle man gärna vilja framföra en önskelista:

- 1) Utförligt register över alla latinska namn inklusive synonymer;
- 2) Examinationsscheman ledande fram till familjer;
- 3) Några råd om tekniska förfaringssätt för framställning av t.ex. bladtvärsnitt (som så ofta hänvisas till!), färgning etc.

I övrigt kan endast önskas, att förf:s hälsa och krafter ska räcka till även för del 6, varmed detta imponerande floraverk får sin avslutning. Därefter för Norden lyckligt nog att, förmodligen som enda område i världen, äga en fullt modern mossflora, där alla bladmossar och de ojämförligt flesta levermossar är avbildade med goda, tecknade illustrationer. Vad som är art och vad som har lägre taxonomisk värde kommer man i talrika fall förmodligen ändå alltid att smågruffa om.

EDVARD VON KRUSENSTJERNA

IVAR ELVERS: Vår flora i färg. — Stockholm (Almqvist & Wiksell) 1966. 321 sid. Pris inb. kr 17: 50.

Denna nya färgflora har liknande utförande som BOLIN-VON POST, *Floran i färg* (1950), som den är avsedd att ersätta. Den skiljer sig från föregångaren bl.a. genom ett par nytillkomna avsnitt. Ett kapitel om botaniska termer ger en lättfattlig och starkt förenklad framställning försedd med schematiska figurer. En del begreppsförklaringar är tämligen okonventionella och ibland väl summariska; det gäller t.ex. blomställningarna, där kvast beskrives som en »klase som ser ut som en flock».

Ett tolvsidors examinationsschema med sex delnycklar ger nybörjaren möjlighet att bestämma de vanligare arterna, eller åtminstone släktena eller familjerna, med ett minimum av botaniska förkunskaper. Fallgröparna är emellertid många, och ett särskilt kapitel ger råd om man misslyckas med bestämningen. Nycklarna är inte strängt dikotomt uppbyggda, utan ända upp till sju valmöjligheter förekommer. Risken att något eller några alternativ förbises har emellertid eliminerats på ett lika enkelt som effektivt sätt: alternativen är numrerade i omvänd ordning (t.ex. A3, A2, A1)!

Florans huvuddel är givetvis färgbilderna med tillhörande växtbeskrivningar. 667 arter avbildas och ytterligare drygt 80 beskrivs i texten, mot den tidigare florans 620 resp. cirka 25. Arturvalet har gjorts med tanke även på den danska utgåvan, varför de sydliga arterna är väl företrädade. Tonvikten ligger på de iögonenfallande arterna, medan t.ex. halvgräsen blivit mer styvmoderligt behandlade (*Juncaceae*: 6 arter avbildade, *Cyperaceae*: 16 arter).

Färgbilderna är helt nytecknade (av HENNING ANTHON), och man väntar sig kanske därför enbart förbättringar. Dock är många bilder i rec:s tycke klart sämre än motsvarande i BOLIN-VON POST (*Sagittaria sagittifolia*, *Elodea*, *Fritillaria*, *Allium ursinum*, *Tofieldia*, *Sesleria*, *Holcus lanatus*, *Carex rostrata*, *Eupatorium*, m.fl.). Ibland är konturerna onödigt suddiga och färgerna, särskilt de gröna, onyanserade och något grälla (se t.ex. figg. 366—369). Även blomfärgerna, i synnerhet de röda, har ibland utfallit olyckligt (*Epilobium hirsutum*, *Cynoglossum*, *Vaccinium myrtillus*, *Calluna*, *Anagallis*, *Centaureum-*

arterna). *Scleranthus perennis* har fått en egenartad turkosartad färg. I stort sett har dock den botaniskt skolade konstnären träffsäkert återgivit resp. arts habitus, och ofta är dessutom de väsentliga detaljerna tydligt framhållna. De flesta caryophyllaceer (särskilt *Stellaria*- och *Cerastium*-arterna) och cruciferer (tydliga fruktkaraktärer!), samt lövträden (jfr t.ex. *Alnus*-arterna) är bättre avbildade än hos BOLIN-VON POST. I vissa fall utfaller jämförelsen t.o.m. mycket markant till den nya florans fördel (*Saxifraga aizoides* och *nivalis*, hägg, slån, *Rubus caesius*). En lovvärd detalj är de svarta pilarna, som på en del bilder utmärker de viktiga detaljerna.

Växtbeskrivningarna har gjorts utförligare och upptager lika stort utrymme som färgbilderna. Trots ordrikedomen ger de dock i många fall knappast fler upplysningar än föregångarens koncisa telegramformuleringar. En del tvivelaktigheter har insmugit sig i texten. Påståendet att *Polygonatum multiflorum* jämfört med *P. odoratum* är »en betydligt mer sällsynt och exklusiv lundväxt» förefaller något överdrivet. Förundran väcker konstaterandet att *Salix glauca* står släktskapsmässigt nära *S. lapponum* »och förenas därmed genom mellanformer». Benämningen frö används något slarvigt, t.ex. om *Ranunculus*-frukterna. Hos *Avena pubescens* framhävs i både text och bild de håriga bladskivorna som viktig karaktär; det borde varit bladslidorna. Tryckfelen i bildtexterna är onödigt talrika (en hastig genomläsning avslöjade ett tiotal) och ibland besvärande (t.ex. »*Gotoneastre*»!).

De starkt schematiserade utbredningskartorna hör till bokens största förtjänster. De ger på ett minimum av utrymme en åskådlig och ögonblicklig bild av arternas utbredning och frekvens. Någon enstaka gång kan kartbilden verka förvillande eller missvisande. Så t.ex. markeras *Ophrys* ej från Skåne, däremot *Coeloglossum* och *Orchis militaris*. *Orchis mascula* uppges endast för Skåne och Öl-Gtl, *Senecio vernalis* endast från Skåne, o.s.v. Kartbilderna för *Alchemilla alpina* och *A. vulgaris* har råkat bli ombytta.

Trots talrika anmärkningar blir helhetsintrycket av boken tämligen gott. Som lättillgänglig färgflora för nybörjaren kan den rekommenderas.

BERTIL NORDENSTAM

STEARNS, W. T.: Botanical Latin. — Thomas Nelson and Sons Ltd. London and Edinburgh 1966. xiv+566 pp. Price (U.K.) 105 s.

Latin is since long the technical language of descriptive taxonomy. During the course of centuries this language has acquired such a distinctive character as to warrant a special designation, viz. "Botanical Latin". Names of new taxa of plants must nowadays be accompanied by a Latin diagnosis in order to be considered as validly published, this rule being firmly laid down in the International Code of Botanical Nomenclature. The choice of Latin as the universal obligatory language was as natural as it was a happy one, because of its neutrality, stability, preciseness and conciseness. Nevertheless, modern botanists with little or no training in classical Latin often have difficulties in acquiring the essential minimum knowledge of Botanical Latin.

Swedish scientists have been more fortunate than colleagues in most other countries in having had since 15 years a very useful handbook in WIKÉN, 'Latin för botanister och zoologer'. It is by no means obsolete by the appear-

ance of STEARN's publication, the approach and scope of the two works being rather different. It is significant that STEARN dedicates his book jointly to WIKÉN and to Dr. H. T. CROASDALE (an expert on phycological terminology) "in appreciation of their help over many years to botanists perplexed by the Latin language".

STEARNS 'Botanical Latin', however, is the first book on the subject written for botanists by a botanist, and the result is a masterly handbook.

The work is divided in four parts. The introductory contains, inter alia, an interesting exposé of the history of Latin as a botanical language. Part Two deals with the grammar in an illuminating way with numerous examples carefully selected from the field of botany.

Part Three is the largest and the most useful, if this distinction is allowed. It deals with all aspects of botanical descriptions and terminology, with selected illustrations. About 80 diagnoses and descriptions are quoted in full with literary English translations. These examples are chosen from all main divisions of the Plant Kingdom and will no doubt come to serve as useful models to students trying to draw up their own descriptions. Special chapters are devoted to the latinization of geographical names, to colour terms, symbols and abbreviations, etc.

Part Four, finally, contains a very useful and exhaustive vocabulary with numerous cross-references (170 pp.).

Besides the major items mentioned many other aspects of the subject are treated. In addition to its usefulness the book often provides quite fascinating reading. Botanists all over the world are to be congratulated to the access of this splendid handbook.

BERTIL NORDENSTAM

PETERSON, BO: *Bibliographia Skottsbergiana* II. Förteckning över professor Carl Skottsbergs efter den 1 december 1940 av trycket utgivna skrifter. — Göteborgs Kungl. Vetenskaps- och Vitterhets-samhälles Handlingar. 6. följd. Ser. A. Band 7. N:o 4. Göteborg (Wettergren & Kerbers) 1966. 88 pp. Price Sw. kr 15: —.

This valuable bibliography is a direct continuation of HALLBERG & MARKLUND, *Bibliographia Skottsbergiana* (in *Medd. Göteb. Bot. Trädg.* 14, 1940). Altogether 371 scientific works are listed, the present volume starting on 221. The number of SKOTTSBERG's newspaper articles, mainly book reviews, totals 1185.

The value of this comprehensive bibliography is further enhanced by the detailed indexes concluding the second volume.

BERTIL NORDENSTAM



## Notiser

**Umeå universitet.** Till professor i fysiologisk botanik vid Umeå universitet har utnämnts universitetslektor P. H. HALLDAL, Göteborg.

**Naturhistoriska riksmuseet.** Förste intendenten vid Naturhistoriska riksmuseet BRITTA LUNDBLAD skall uppehålla professuren i paleobotanik därstädes till 1 jan. 1968.

**Utmärkelse.** Professor J. A. NANNFELDT, Uppsala, har av Kungl. Fysiografiska Sällskapet i Lund tilldelats Linnémedaljen i guld.

**Anslag till Botaniska Notiser.** Statens naturvetenskapliga forskningsråd har utdelat ett anslag å kr 22.000 till Lunds Botaniska Förening för utgivande av Botaniska Notiser under 1967.

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